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Geography and Geodesy Section of the Indian Science Congress, Lahore Session, Jan. 1939.

Sitting: Miss G. W. Mason, Dr. S. P. CHATTERJEE (Recorder), Prof. N. SUBRAHMANYAM (President), Mr. A. K. BANERJI (Local Correspondent), Mr. M. Subrahmaniam.

Standing: Prof. E. T. DEAN (Local Sectional Secretary), Syed Gauhar Ali, Mr. B. M. Thirunaranan, Mr. M. L. Rengen.

The Journal of
The Madras Geographical Association

Vol. XIV March, 1939 No. 1

The Geographical Personality of India *

By

N. Subrahmanyam, M.A., L.T., F.R.G.S.

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* The Presidential Address delivered at the section of Geography and Geodesy in the Sessions of the Indian Science Congress Association held at Lahore, January 4, 1939.

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The Future :
Physical and Human Factors
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My first duty is to thank, on behalf of Geographers of India the authorities of the Indian Science Congress Association, for their constituting permanently Geography and Geodesy as a separate section. Such recognition of the importance of Geography by the Premier Science Association of the land will prove of help, it is hoped, to stimulate Geographical Thought and Research in India.

In this Address, I propose briefly to deal with 'The Geographical Personality of India,' and dwell upon some Leading Geographical Elements in Indian Life, past, present and future ; and I shall indicate, from both the physical and the human side, their basic and dynamical aspects. The theme is vast and each statement bristles with exceptions, only too many; still, it is of value to have a synthetic and panoramic view of those several forces at work, as they are only too often lost sight of.

2. 1. We are met to-day in the Punjab, a Region whose greatness is pre-eminently the gift of its Geography. Its situation at the head of India has given it importance throughout History ; its fat plains, overflowing with milk and honey, respond to the

generous touch of water, yielding yearly, corn and pulses and oil in abundance. Great as theatre of wars in the past, it is to-day the field where victories of peace are garnered, witness the engineering triumphs of the Triple Project; the several Water-works and Hydro-Electrics; or the Canal Colonies.

2. 2. *Punjab, a Cultural Cradle.*—Sheltered behind natural frontiers of loftiest ranges and spreading along mightiest rivers, it has been the cradle of Indian Civilization from Pre-Historic Times. The Soan Culture; the Harappa Civilization linked to Mohenjo Daro; the Dravidian or Sumerian and the Vedic Civilizations—all have had here their growth and development. To the Punjab belong the great names of Sanskrit literature, Vyasa, Panini, Patanjali; Kurukshetra; the Kuru-Panchalas and the Gandharas; King Poros; King Kanishka; the long line of Kashmir Kings; the great monarchs of Afghan Dynasties and the Mogul Emperors of Delhi and Kings from Prithvi Raj to the Sikh Ranjit Singh who ruled with supreme dominion over the Northern Punjab and N.W.F. Province.

2. 3. *Punjab, varied folks.*—In historical times, the mountain ramparts guarding the Punjab opened their gateways only to peoples more powerful at the time and shut them on the weaker ones—Persians and Greeks; Sakas and Huns; Arabs and Afghans; the Tartars and Moguls. It is only the last conqueror—the Britisher—who has come to the Punjab by way of the plains through the Sea-gate of India; and he, too, though himself no settler, has dowered on it his gifts of war and peace, enriching it like every other race and religion before.

2. 4. *Punjab, Great in the making.*—The British Sergeant has been very much abroad in the Punjab; and better disciplined men than the Panjabis, there are none, in the rest of India or even the world. The Hindu, Rajput, Jat, Mussalman and Sikh, all animated with burning zeal for their religion, have been bred to arms and can wield with equal dexterity the pen and the sword, vying with each other only in their willingness to render service. The modern composite civilization of India is developing best in the Punjab; and the strength of the Punjabi is the strength of India. The Punjab is India in miniature and India is a miniature of the world.

PART I—STATIC GEOGRAPHY OF INDIA.

3. 1. *Personality of India.*—Though a Microcosm in her infinite variety, India has her own Personality, great powerful and strongly marked off, by prominent features, from other countries

of the world. From Cape Comorin to the Himalayas, from the Yomas on the East to Eastern Afghanistan on the West, there is a Geographical Unity binding land to land in bonds of Sun and Wind and Rain, varied by relief and the sea. The fundamental unity is that of climate, which is hot and monsoonic, the cold season even of North India being but of short duration. There is, besides, a unity of civilization, colouring, shaping and regulating the lives of her men and giving them a common outlook. Historically, various cultures have entered into the making of her civilization; and in the diversity and range of those cultures lie the greatness and comprehensiveness of Indian Civilization.

3. 2. *India, not a Geographical Expression.*—India it has been said, is a Geographical expression, a saying adapted from Metternich and intended to stress the political disunion and want of cohesion evident at present. But her true frontiers have been set out by Nature; her civilization has been developed and evolved so as perfectly to befit and envelop her as her atmosphere. And if political union remains the last to be achieved on Indian Soil, slow as it is in coming, the struggles that are witnessed are but the pangs of its birth.

3. 3. *India's Frontiers in History.*—Throughout the ages of her long history, the dictates of her Geography have impelled her rulers to extend their realms to the natural frontiers. Political union has been the aspiration of her great rulers. That was the urge behind the Hindu Aswamedha (the Horse Sacrifice) of old, celebrated by the Powerful Monarch of the day in order to become the Suzerain (Samrat) and bring all India under one Umbrella (Ekachhatradhipati), be he the legendary Raghu or the Pandava, the historical Pushyamitra or Samudra Gupta. That was the urge behind the Moslem conquests of the Sultans and Padishahs of Delhi—Sher Shah, Akbar or Aurangzeb. The dictates of Geography it is that have been the urge behind British Expansion in India, through Wellesley, Ellenborough, Dalhousie or Curzon, successors all to the Great Mogul, eager to enter upon the entire heritage of the Mogul.

3. 4. *Some countries not within.*—Alone of the Mogul heritage, Afghanistan and the Hindu Kush have kept out of the British System, cherishing their innate Love of Liberty and their Independence; while the differentiations of two centuries have made them quite distinct from India. They were once Hindu and Buddhist before embracing Islam; they have had relationships of race and language and religion with the West Indus Regions. Historically, too, they were linked with India under

Hindu, Buddhist, Afghan and Moghul Rulers, until about hundred and twenty years ago.

3. 5. *Variations.*—Other countries have now and then come into, and gone out of, the British Indian Empire. It is India's destiny to win for British Raj territories like Burma and develop lands like Natal and East Africa until the Indian ladder is no longer wanted. Other such examples are Aden and Singapore. They do not belong to India.

3. 6. *Ceylon.*—The contiguous Island of Ceylon, but for modern political accidents, ought to have been part of it, by virtue of geographical unity, of similar civilization, and of ethnic affinities, both the Sinhalese and the Tamils there being but immigrants from the mainland.

3. 7. *Why, the Historical Difference.*—In establishing an Indian Empire stretching to the farthest extent of natural limits, the British have succeeded where their great predecessors failed. But then, the British have, at their command, all the resources developed by the knowledge of the West—by knowledge created only in modern times and, therefore, not available, to the former rulers of India,—for the purpose of mastering the baffling immensity of the problems, such an Empire presents.

4. *India, a Sub-continent.*—It should be remembered that India is a Sub-continent, considering her vast extent, her great size, her immense and diversified population, or her infinite variety. Thereby, every Indian question is rendered multiform and manifold, and made more complicated and difficult than are such questions in other countries. Be it the problems of defence or poverty, the removal of illiteracy or the conquest of malaria, the reconstruction of villages or the building of roadways, their magnitude and proportion underscore every effort and have first to be tackled and overcome and provided for, before any appreciable results can be perceived.

5. 1. Climate.—The climate, which stamps this extensive region with its unity, is moulded by India's situation and configuration.

5. 2. *Situation.*—On the face of the globe, her situation is half within the tropics and half within the temperate zone, which is however contiguous to, and in unbroken continuity with, the tropical part, and by consequence partakes of its features. And

she stands a Peninsula at the head of the Indian Ocean, flanked on either side by receding land masses, which reach down to South Africa on the West and to Australia on the East.

5. 3. *Configuration.*—Her configuration is a quadrilateral, whose two Southern Sides jut far out into the sea and whose Northern Sides cut her off from the land masses of Asia by huge mountain barriers of far-flung mountain ranges.

6. 1. *The Sun.*—Over the region thus bounded, the sun dominates fiercely; it burns with tropical and sub-tropical intensity, flooding it with blazing light and heat. The sun helps in making the soil; and (according to Dr. Dhar, the Bengali chemist) is the more potent factor in its nitrogen fixation. The energy of the sun calls up a luxuriant growth of tropical vegetation where water and other conditions of plant life are present. The sun gives the Indian, warmth, health, and wealth.

6. 2. *The Seasons.*—The regime of the sun has a marked influence on the cycle of seasons, which in South India are described as hot, hotter, and hottest; while in North India the hot season is succeeded by a cold winter of only about four months' duration, unaccompanied by snowfall and frozen rivers on the plains. In essence, India is a hot land, one of the hottest on the globe, the range of temperature varying from about 4°F., in the remote South to 40°F. in the far North.

7. 1. *Wind Circulation, The Monsoons.*—The difference in the sun's heating of land and water in the Northern and the Southern Hemisphere in spring and summer and in autumn and winter, creates extensive and mobile areas of low pressure; and generates the circulation of the winds, which, in India, definitely follow the seasons and are therefore called monsoons. They set in, in steady direction, from the South-West in spring and summer, veering to the North-East in autumn and winter. By these winds, nature tempers the climate to the people. For, the former, the S.W. coming from the relatively cooler southern seas, brings clouds and rain to mitigate the heat; and the latter, coming from cold masses, makes the cold season so very delightful.

7. 2. *Wind and Heat.*—The winds influence the temperature of the lands over which they blow, not only with their intrinsic hotness or coldness but also with their dryness or humidity. Hence, the steaming heat of Bengal and the dry heat of the Pun-

jab in summer; the bitter cold of Sind in winter and the humid cold of Eastern Himalayan Regions.

7. 3. *Wind and Power.*—The prevailing Winds blow over large tracts of country with steadiness and regularity for long spells at a stretch, and can be a primary Source of Power in India; and it is a wonder that it has not been yoked to the service of man by windmills designed to suit the several velocities of wind at the place.

7. 4. *Wind, Cyclones.*—It is not unusual in India for gusts of wind to blow gales and hurricanes and cyclones; when they occur, they spread devastation before them over hundreds of miles, felling trees, destroying houses, cutting up embankments and scattering boulders and rocks. Some of these have been known to career across, in unabated fury, from the East Coast to the West, a distance of over 300 miles.

8. 1. *Water Circulation, The Monsoon.*—Intimately connected with the Winds is the Circulation of Water. In so agricultural a country as India, the importance of water cannot be over-rated; indeed, it is said even of the Government of India that its finances are a gamble in rain. The people are accustomed to watch the skies for the monsoon-burst, the break of the monsoon; the village *Panchik* (the calendar-man) ekes out a livelihood, by forecasting for his place, the raininess of the year and its dates, as handed down to him and taught him by local observation, by a sort of rule of thumb.

8. 2. *Its Regularity.*—Fortunately, the monsoon rains, in a normal year, are regular, almost punctual, and visit places at appointed dates, as it were, like an Ocean-liner. The distribution of rainfall over the several dates is equally important with the quantity of rain falling; for, the several agricultural operations are timed to both.

8. 3. *Local Rain.*—From the wind-borne rain-clouds, each place gets of rain what it can, by virtue of its relief, both in elevation and aspect; of its situation such as proximity to the sea; and of its hotness, too. The highest rainfall in the world, over 500 inches, is at Cherrapunji in the East, in the Khasi Hills, the farthest destination of S.W. winds; and on the West, Jacobabad, which is in the region of the Indian desert (desert, for want of rain) has under 5 inches of rainfall. The plains of India are a great evaporating cauldron, the sun and wind evaporating agents; while the lee side of mountains suffer often from Drought.

9. 1. *Tank and Well.*—Excess of rain or its Want or its Inadequacy makes abnormal years; and against such visitations, a net-work of tanks impounding surface-water and linked, it may be, in series, and of wells tapping underground water, studs the lands where they are incident. These make some sort of provision against threatened Famine.

9. 2. *Rivers.*—The principal life-giving waters in India are her rivers. The Indus, the Ganges and the Brahmaputra, from their Himalayan snows to the sea, along with their tributaries from the Himalayas, the Western Mountains, the Aravallies and the Vindhyas, make the soil and support life, spreading fertility over all the vast Indo-Gangetic plain. Together, they form the largest, the longest and the mightiest of river-systems, ever utilized by man. Their relief and gradient provide sources of power which have but just begun to be tapped.

9. 3. *Canals.*—Dams have been built across them; and hundreds of miles of canals, taking off them, water millions of acres and sustain human life by the million, where the bison browsed and jackals used to howl.

9. 4. *South Rivers.*—Other great River systems, south of the Vindhyas, flow across the mainland; but they are not snowfed; and not all of these have been fully utilized. The best utilized are the Godavari and the Krishna and the Cauvery; and the least, the Narmada, the Tapti and the Mahanadi.

9. 5. *Floods.*—Sometimes, the Rivers overflow their banks; and then those floods are irresistibly destructive, as in Bengal in September last when over 20,000 square miles were submerged by them.

9. 6. *The Flood Problem.*—As an example of Indian problems it may be stated that a Committee was appointed so recently as August, 1938, to study the Mahanadi system with a view to building dams across it, if only to prevent its frequent and destructive floods; one attendant circumstance being that, where it emerges into the plains, the area irrigable by canals is small relatively to to the cost involved.

10. 1. *Drought and Famine.*—Whether rain-fed, river-fed, or canal-fed, lands in India are frequently subject to droughts, and then the gaunt spectre of famine stalks over the land. Modern Transport brings relief to distressed areas; and upon their experience, the British have built up a regular Famine Code to deal with

it promptly and to mitigate its incidence. But modern famines, however, are due to want of pence rather than want of water, to economic rather than geographical causes. Be that as it may, the loss of human life is appalling; and that of cattle is beyond description.

10. 2. *Famine of two Kinds.*—Famine is said to be the skeleton in the cupboard of British India; but it is true also of Indian India and Past India. Geography reveals the true character of famines by polarizing the famine into two, and showing how that part which is due to Geographical factors is ever being alleviated, instead of being aggravated, by expansion of irrigation and similar public utilities.

11. 1. *Coast and Sea-life.*—India has an extensive Coastline of over 3,400 miles—over 4 times Germany's—presenting on the East Coast surf-beaten and breaker-swept sandy shores, and on the West Coast, many a land-sheltered cove and harbour. Fishermen still ply their drag-nets, and *catamarans* and *masula* boats still ride on the surf, as in ancient days. It is a fact that the frail boats of India, following the wind, carried in those days *Indian commerce* and *civilization to such distant countries* as Sumatra (Sri-Vijaya), Java (Hindu Remains from 1st cent.) and Borneo (Yupa, Sacrificial post, of VI cent. A.D.); to Indo-China (Angkor-Vat); and Canton; and Japan (Bodhi Sena of South India there in VIII century A.D.).

11. 2. *The Sea-sense.*—But the Sea-sense has not had a strong *development among Indian people. The coastwise plain is cut off* by high relief; while the foci of Indian Civilization have been too far away in the Inland to receive the influence of the sea and to be influenced by Kaveripatnam or Musiris (Cranganore), Kalinga or Dwarka.

11. 3. *Indian Seamen.*—When the need arose, the Mahrattas of the West Coast developed into seamen, building ships and manning them; and the seamen of Chittagong are even to-day esteemed as laskars on British Liners.

11. 4. *Landsmen in Modern Crew.*—Such is, however, the modern division of labour that bands of men from Amballa, for example, (more than 600 miles from the nearest sea) find employment as firemen in British Steamers.

11. 5. *Sea, as Defence.*—So impossible it was to invade India by Sea in ancient and mediaeval times that the Indian Poet, Kali-

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dasa, conceived of the Coastline as Ramparts and the Seas a Moats, together forming an impregnable defence. But the compas and the gun have made the European in his floating castle maste of the sea and all it circles. And the Command of the Sea it : that has given India to the British, keeping out every othe European rival.

12. 1. *Mountains as Defence.*—The Mountains form anothe impregnable chain of ramparts, extending and completing the se defences. The high, huge, and extensive Himalayan Systems ar over 1,800 miles long; the Eastern mountains are clad wit impenetrable forests; and on the West high bleak mountain protect India, opening only at seven passes. But it was throug them that there poured into India all her invaders and conqueror but one. The British alone have come by sea, transmuted fror Traders into Rulers by the heat generated in the Politics of India' Rulers of XVIII Century.

12. 2. *Mountains as Barriers and Frontiers.*—These moun tains still remain, what they have been, the Natural Barriers an Frontiers of India; and the military concentration is in the Punja and N.W.F. Province, where the Indian army keeps incessant watc and ward against the virile and warlike tribes of the borders an races of Afghanistan and Central Asia.

13. 1. *Forests, Varieties.*—Forests play a large part in India' economy. They are of various types, sub-equatorial as on the Wes Coast, growing teak and jack and sandalwood; sub-tropical as th sal and blackwood; alpine as in the Himalayas with deodar and chi and juniper; terai at the Himalayan foothills with giant grass an bamboos, sheltering elephants; while all over may be seen the scru jungle preserving game. Where forests are, there water is conserv ed, soil preserved from erosion, temperature lowered, and rai attracted.

13. 2. *Forests as Home.*—The forests have been the home an defence of the aboriginals and fugitive peoples, protecting ther in their independence, as witness the Bhils, Oraons, Mundas Gonds, Kolas of the Vindhyas; the Santals and Khonds of Chot Nagpur; the Savaras of Agency Tracts of Ganjam; and the civilize Garhwals and Nepalese, in the Himalayas.

14. *Plateaux.*—The Plateaux have been so subdued to civilization that they are different from the plains only in the regime of climate and the potential power that relief may give them by way of waterfalls, etc. Such are the C.P. and Mysore.

15 *Plains, the Pagoda Tree.*—The vast Plains of Hindustan, provided with no natural defences save their own extensiveness like the Russian, fertilized by its mighty rivers, and civilized from ancient times, have been the cynosure of the world ; and the wealth of India has been the standing temptation to all the world, through all the ages. Here grew the fabled pagoda tree to be shaken by the strong arm, in order to bear and yield its fruit. The land is wealthy still, bearing rich harvests and producing the manufactures of industrious folks.

16. *India's Self-Sufficiency.*—The first prominent feature of this extensive country has been its self-sufficiency. With its rich harvests, its famous looms and artisans, it used to meet and for the greater part, meets, to this day, most of the natural needs of civilized life by way of food, clothing and shelter.

17. 1. *Isolation.*—The most natural consequence of such a condition is isolation. This has been intensified by the Mountains which cut off India from her neighbours and by the Seas separating her from other countries by hundreds of leagues which were almost impassable by old-time ships. The mountains of the mainland have erected yet other barriers between the same folks and have carried the isolation further by creating inner isolations, isolation within isolation. Add to these the great forests and the different rainfalls and we have a geographical view of that double isolation.

17. 2. *Isolation within Isolation, Examples.*—For example, from Bombay in the North to Cape Comorin in the South, we have the Mahratta, the Kanarese, the Coorgi, the Malayalee, each feeling himself distinct, and jealous of his distinctness, from the rest of the world. From West to East along the Vindhyas there are Hill Tribes feeling likewise ; and Subregional Criteria such as mountain, forest, temperature and rainfall differentiate the Punjabi, the U.P. Wala, the Biharee and the Bengalee, from one another, filling each with gladness that he is not like the rest.

17. 3. *All making for Rigidity and Variety.*—One result of such isolation is the insusceptibility to outer influences as such ; a rigidity within the larger framework. For the very same reason, there exists a rich variety in India of cultures differently evolved, each tenaciously holding by its own.

17. 4. *Isolation in Neighbourhood.*—The peculiarity of the inner isolation is that it is isolation in neighbourhood.

18. 1. *Toleration.*—From this twofold character, there have sprung up in India widespread Toleration; a willingness generally to live and let live; and an all-embracing catholicity of spirit.

18. 2. *Simplicity and Subjectivity.*—Again, the necessity of making the best of the area to which folks have confined themselves voluntarily or otherwise, has given rise to pervasive simplicity and intense subjectivity. Plain living and high thinking still commands respect in India (e.g. Sir P. C. Ray, Gandhiji, Malviyaji).

18. 3. *Spirituality.*—Further, all these factors have contributed to make India stress more the spiritual side and provide her with varieties of religious experience. It is sometimes said that the history of India has been the history of her saints. From the Vedic seers to Buddha, from Mahavira to Vivekananda, from Guru Nanak to Ram Tirath, there have been towering peaks of religious teachers, raining their influence upon myriads of followers. Srijut Aurobindo Ghosh is the latest Seer in the long line of India's spiritual mission. Even Emperors like Asoka and Akbar live on by their spiritual enlightenment while the glory of their regal splendour departed with them.

19. *Stability of Indian Civilization.*—These and other such factors have imparted, to Indian Civilization, the quality of Stability; and it has been able to survive the pomp of kings and circumstances of war; the tramp of invaders and marauders; and the insidious attractions of a different life.

20. 1. *Caste and Castism, all-pervasive in India.*—Next only to Isolation in range, and re-inforcing it with its ever-present power, stands Caste in India. It may have evolved at first as occupational differentiations; or as a mode of living together, side by side, of two different folks, without letting each be absorbed by, or in, the other. Caste has dovetailed itself into the Map of Life in India so perfectly, and plays its part so completely in domestic economy that even conquerors like the British, who in their own home, have none of it but class differences, manifest symptoms of Castism here. To remain aloof outside the contacts of business; to live, move, and have their being in worlds of their own kith and kin or race, may be merely the psychology of birds of a feather flocking together. A dread of miscegenation of two hostile or alien races or religions looms behind.

20. 2. *Caste and Occupations.*—But in India caste has developed further into trade guilds and occupations. Even now in cases where there is equality of opportunity, Caste determines the choice,

understanding by the term caste not only the Hindus but those others in India who observe it in all but name—the casteless Quasi-Caste. Of course, its ugly feature is the principle of hereditary occupations with resulting stagnation and the habit of looking up and looking down on one another.

20. 3. *Caste, subserving Social and Economic life, and alive.*—But because its roots are deep down in the social and the economic life of India, it leads a charmed life, denounced in theory but accepted in practice. Doomed to death but fated not to die, caste lives on. It lives on, not only because it ministers to the social and economic needs, if not vanities, of man in India, but also because it has ever been adapting itself slowly, gradually, if inevitably, to ever-varying demands of modern conditions of life.

21. 1. *Variety by Regionality.*—Variegated as is the indigenous culture by the double process of Isolation and Caste, it is quadrupled by geographical elements of each region. Hindu civilization retains, in the main, the features of its forest origin and nurture, though the forests have disappeared long since. This has been operated upon by the local geography of each considerable tract.

21. 2. *Desert Type.*—The thrifty habits of the Marwari and Multani, and in recent times, the Nattukottai Chettiar, make them the money-lenders and financiers of India. Those habits derive from their desert homes of Malwa and Rajputana and Ramnad. Men of Jaipur, Jodhpur, Bikanir, Alwar, Shikarpur, Multan are spread all over India ; and they it is that back Indian Trade and Industry, taking any risk.

21. 3. *Mountain Type.*—The Mahrattas from their emergence into history have proved on many a battlefield their indomitable courage ; their ability to hold their own ; and their capacity to hold together. The Great War in which they were recruited to the army after long lapse of time has shown that those qualities are not accidental but inherent in them as the gifts of their mountain home. Added to their courage, is their skill in diplomacy and politics. Poona has been the nursery of statesmen, even in modern times. Ranade, Gokhale and Tilak are household names. One noteworthy feature is that the women of Maharashtra have been specially brave, accompanying their men-folk to battle and accepting with them death and glory.

21. 4. *River and Plains Type.*—River and plain have developed other types. The Bengalee is well-known for his intellect and

his great heart is susceptible to just emotions. He has been a leaven of intellectual and social life wherever he has settled.

21. 5. *River, Plains and Desert Type.*—The Sindhi, also belonging to river and plain but under desert influence, is energetic, ubiquitous, venturing abroad if he can make a pile of pice by bartering in the lion forests of East Africa or by hawking in the streets of Lancashire.

21. 6. *River, Plains and Mountain Type.*—Developed under river and plain and mountains, the Punjabi is strong of will and body and mans half the Indian Army.

21. 7. *Coastwise Plains Type.*—The dry coastwise districts of Madras send out the largest number of emigrants yearly and the Plantations of the British Empire—of Natal, Malayan States and Tropical Islands from Trinidad to Fiji—owe their prosperity to the untiring labour, exceptional patience and frugal living of Madras Coolies.

21. 8. *Plateau Type.*—It is remarkable that men of inland plateaux are least disposed to go abroad while those of rivers and plains are best disposed, as seen in the case of the Sindhi and the Bengalee.

22. 1. *Homogeneity by Geography, The Bengalee.*—Another geographical result is seen in Bengal, where the land is a well-watered level plain scarcely rising to three hundred feet in three hundred miles from the Sea. The Bengalees, despite all differences of caste, creed and colour, are more homogeneous than others in India ; possess widely diffused general culture and are highly responsive to modern impulses, thanks to their travel-sense and sociability, which are themselves induced by their Geography.

22. 2. *The Sindhi.*—Geographical influences have moulded a similar homogeneity in the riverine and desert plains of Sindh.

22. 3. *The Punjabi.*—Another region where the genius of the place makes people homogeneous in spite of themselves is the Punjab.

23. 1. *Individualism of Mountain-dwellers.*—The largest differences are observable among the Mountain and the Forest folks, where each body of people clings tenaciously to its own, changing only when it must. They develop stern individuality.

23. 2. *Illustrations.*—Districts from Konkan to Orissa as well as Nepal and Coorg and N.W.F. Province furnish illustrations.

24. *Variety by Impacts from outside.*—This great variety in India due to all such causes has been increased, and not diminished, by the impact of cultures from outside.

25. 1. *Islam, a Great Levelling Influence.*—The Muslims of India are the largest in numbers of the Moslem world and among the most devout. Islam, moulded in the deserts of Arabia, strong with the strength of Central and Western Asia and sweet with the perfume of Persian Letters, has, for twelve centuries, been spreading its levelling influence in India.

25. 2. *Harijan Problem the least.*—It is a striking fact that the Harijan question is negligible in Sind and the Punjab, where Islam is prevalent, while it has remained a great question where Hinduism is strongest as in Kerala (Malabar).

25. 3. *Regionality in non-religious matters.*—Yet in *non-religious* matters, there are regional differences. To cite only a few examples: The Moplahs of Arab descent inhabit the valleys of Malabar; they are peasants and traders and have retained their Arab qualities. The Muslims of Bombay and Sind hold a most commanding place in the trade and commerce of India. The administrative talent of the Delhi and the U.P. Muslim is generally acknowledged. Several of the Bombay Trading Muslims have the joint family system.

26. 1. *Variety by Christianity.*—Christianity came to India early. The Syrian Christians of Malabar date from the first century A.D. But only when the Christian Powers of Europe came with the gunboat, first for trade and then for conquest, did proselytism commence on a large scale. The Inquisition worked at Goa and gusts of Christian zeal used to sweep over Pondicherry. The British kept aloof, letting their subjects live and worship their own way. They opened the door to the missionary only in the XIX century; and here, too, it is to be noted that the largest number of Indian Christians is in South India; and therein, in Malabar and contiguous districts, where Hinduism is strongest.

26. 2. *Variety of their Denominations.*—All the varieties of Christianity are here in India (except the Pre-Soviet Russian Church) with all their denominations.

26. 3. *Variety of European Culture in India.*—And in other than religious matters, the genius loci establishes its influence,

adding new varieties to the old. Along with their religion, th Europeans have brought their modes of life, developed in the col countries of the Eastern Atlantic Seaboard. As observed befor they found the caste system in India and have fitted themselv into it, living apart in a world of their own, disdainful, it may b and exclusive like caste-men. The variety among them, howeve: is not so much due to Indian Geography as to the Geography o their several homes; for, they have not settled in India so as t be subject to her influence.

26. 4. *Variety by Parsis, etc.*—The Parsis, fleeing with thei sacred fire before the Islamic sword of Arabia, have found Asylur in India for 1,200 years among the Tolerant Hindus; and they hav enriched their new home beyond all proportion to their smal numbers. They have retained their usages and added to th Variety of India. Others like the Jews and Armenians need n special mention.

27. 1. *Variety by Sects, Jains and Buddhists.*—The Jains are an entirely indigenous sect marked out by the most delicate tenderness for life. We have passed by Buddhism, because Buddhism, born here, is invisible here. But Buddhism left the land of its birth not until it re-created and re-incarnated itself in India in Modern Hinduism, as in Congregational Worship in Temples; abstinence from meat; reverence for life, etc.

28. 1. *Variety by Food, etc. by Food Crops.*—The food of the people follows the lines of geographical distribution. Where ample water supply is available in summer (even in N.W.F. Province) rice is grown. It is *the* monsoonic crop and is the staple food of the Lower Gangetic Plains of Bengal, Behar, and Orissa; of Godaveri, Krishna and Cauveri deltas. Wheat requires less water and more cold and is grown in Central, Northern and Western India, being the staple food there. Ragi, taking much less water, is grown in Mysore. Millet takes up even lesser water; as Jowar and Bajra, it is food and fodder in the dry Inland Regions from South India to the Punjab. Barley, which stands much cold, is found in the U.P. and the Punjab. Of pulses, different kinds there are, suited to varieties of soil.

28. 2. *By Fodder Crops.*—In the pressure on land, the food-and-fodder crop is grown as double utility, for grain and straw, for man and beast. But the rural economy of many a place requires fodder being cultivated as such. Here, and in Haymaking, there is room for improvement.

28. 3. *By Oil-Seeds.*—Oil-seeds are grown following local ariations of soil and climate, and enter into the dietary accord- ıgly, each region selecting its own seeds. Malabar of the coastal lains uses cocoanut oil; ground-nut oil of the East Coast is dis- lacing gingelly oil there; mustard oil is favoured by Bengal; and nseed oil by the C.P. and Guzerat.

28. 4. *By Meat.*—Meat is taboo to Jains and many Hindus; ut even those who may eat it seldom can afford it. Sheep, goats, attle and pigs are also reared for food. Over extensive tracts of ınd, there grow only thorny shrubs which no animals eat but goats, nd which are fit for no other use. By the goats, they are convert- d into human values. India has therefore the largest number of oats.

28. 5. *By Milk, etc.*—Even those who do not take meat are by o means averse to milk and ghee. But their consumption is limited y the quantity available and the quality, which is seldom un- dulterated.

28. 6. *By Fruits, etc.*—India is a land where fruits and nuts ıany be grown in tropical abundance, mango and jack; oranges, gs, and apples; walnuts, almonds and cashew; but the actual ome demand, except in larger Towns, is too little.

29. 1. *The Indian Dietary.*—Examining Indian Dietary at 'oonoor Research Station, Col. McCarrison has declared wheat to e preferable to rice and that the Sikh diet of the Punjab is an ideal ne—the diet of *ata roti* (unleavened bread of whole meal) with ulses, vegetables, ghee and milk (eked out by occasional meat).)ther dietaries disclose deficiencies of one kind or other. But the reatest deficiency of all is the wherewithal to buy food.

30. 1. *Role of Pansupari, etc.*—To Hindu and Mahomedan like, the pansupari is welcome; and it is still the symbolic exchange f courtesies, friendliness and loyalties. There is a consensus in 'orthern India that pansupari and ghee-fried sweets are exceptions) mutually forbidden food.

31. 1. *Variety by Dress.*—While Geography makes available ıany a fabric for dress, climate makes the choice; and caste (in ıe extended sense) settles the shape, mode and style for every ıan, woman and child, departures from which are ruled, eccentric r *idiosyncratic. In India, dress is expressive also of the man's* ılture, caste, and place in society as well as his rank and wealth.

31. 2. *The 'Fur Coat'.*—Lord Morley once illustrated hi opinion of the unsuitability for India of certain political institu tions, by resembling them to fur coat for India. So wide is th range of climate that there are parts of India like the Alpine valley of altitudinous mountains, where a fur-coat would be very welcom to several millions, affording them cosy comfort against cold.

31. 3. *The Fabric.*—India produces Wool, and Silk, and Cottor more than sufficient to clothe her population. Silk (coming at firs from China, in Sanskrit the Chinamsuka) is the luxury of th richer classes. Wool is available for North Indian cold, but is costlier than cotton. The fabric most generally used is simple cotton cloth for the hot days and Padded cotton for the cold. To pass into or out of quilts (Razai in the North or Bonda in the South) is to express the seasonal change.

31. 4. *The Indian Cloth.*—Until eight decades ago, India produced cloth for export, meeting all local demands. Her looms were renowned the world over. The Kashmir Shawl, the Benares lace cloth, the Madura Sari are still sought after. But gone are the days of the Dacca Muslin and such other cloths of fame.

31. 5. *The Indian Customer of Cloth.*—It is, however, the patronage of the poor man for which compete Bombay and Ahmedabad, Manchester and Osaka. Here is a case where Geography provides the fabric and an immediate market for the cloth but the utilization of the one with the other is subject to political conditions and economic factors: the cotton market of Bombay being one of the best organized and most sensitive in the world; and most efficient Manchester watching with Argus-eyes.

31. 6. *Khadi.*—Khadi, or home-spun and home-woven cloth, apart from political significance, is intended to turn the idle time of the Indian millions into self-helping use.

32. 1. *Clothing and Poverty.*—The number of yards a man buys multiplied by their price is a fairly constant factor showing the limitation of his means upon his desires. Favoured by the hot climate, and driven by necessity, the poor Indian goes about scantily clad. Gandhiji, that half-naked faqir of Mr. Churchill's description and received in audience, in such dress, by His Majesty, got into that, out of his longing to identify himself with the millions. A *langoti* (loin cloth) may be all a man's dress, in India: and *Sadhus* are known to brave the winter half-naked on bleak Almorah's hill, by inuring their bodies to it.

33. 1. *Sari, Dhoti, Tailored goods.*—The seamless Sari for ›men, so colourful and so picturesque, is an Indian evolution and s not yet yielded place to western types; the seamless *Dhoti* is · men. The *lungi* is favoured by the Mussalmans who more than ɜ Hindus use tailored clothes, which seem to be of ancient Persian igin.

33. 2. *Shawls.*—In the cold season, in tracts where sudden chills ay be expected, Shawls are carried, slung from shoulders.

.34. 1. *Indian Styles adopted in the world.*—In World Geography e Pyjamas, Jodhpurs and Banians have travelled from India to ner countries; the *Solar Topee* is an Indian adaptation of the hat, iich, by the non-conducting pith of Sola plant, keeps off heat.

34. 2. *The Head-dress, the Turban.*—As observed above, dress ries from place to place and society to society; but in India, the ad-dress of his apparel oft proclaims the man—and the local mate also. It varies from the Malayali and Bengali Nothing which lets the oiled head reflect away the steaming heat—to the ilness of the Punjabi Turban which rises, fold on fold, with tail hind, protecting the head and the nape of the neck from the rce rays of the dry summer sun. Present a cloth to a field bourer in South India and he will tie it to his head as turban cause of its protecting him from heat.

34. 3. *Generality of its use.*—The Turban used to be the article dress common to all Indians; but in the last few decades the ɜz cap distinguishes the Indian Moslem; and the hat is coming to vogue among English-educated Indians.

35. 1. *Variety by Colour.*—White colour reflects the heat falling ›on it and black absorbs it; and accordingly, the favourite colour dress in India is the white; while black remains unwanted; her colours lie betwixt and between.

35. 2. *Sense of Colour.*—The Indian woman has a delicate sense colour; she chooses her sari to match her complexion; and dia foots a colour-bill to Germany running into crores of rupees ɜarly.

35. 3. *Colour, as religious symbol.*—Two colours, the white id the saffron, have trailed from ancient times associations of eligious Symbolism. The white is expressive of ceremonial irity; and the saffron robe—its ground colour, of the earth, rthy—is the dress indicating neglect of material things, worn

by those whose gaze is heavenward-turned (the Sanyasi, the Faqir).

36. 1. *Complexion.*—The skin is the first of dresses; and the Sun has pinched the Indian skin black and brown, whereby the Indian labourer is better fitted for outdoor work under the Indian Sun than the colourless man.

36. 2. *Bathing.*—Pains are taken to preserve the complexion as well as to help the skin to function best. To bathe in oil is a common thing in India; and daily bathing is prescribed by Hindu Law-givers and is observed by the Hindus in their millions, even in biting cold.

37. 1. *Population.*—India contains some 36 crores, a sixth of the world's population, and bids fair to beat China in numbers.

37. 2. *Man Power of India helping British Commonwealth.*—This vast Man Power contributes to the strength and glory of the British Commonwealth and is ever drawn upon to supply British wants in men, whether for War or Peace—Ypres and Natal, for example, speak to that. At Ypres, the Indian army laid down the lives of its men, to stem the on-rushing tide of the German guns and gain time for the British to hurry up and form their lines behind. In Natal, the Indians have created paying gardens for British masters. It has been said that the Indian gardener, without whom many an Empire-country should lie waste, is an Imperial Asset costing but £2 an acre.

38. *Houses and Geography.*—The Houses of *common people* reflect the climate of their locality. We have, for example, in regions of little rainfall, the flat mud roof (Anantapur, Baluchistan); of abundant rainfall, the gable (Malabar, Bengal); of snowfall, the steep slope (Himalayan Valleys); etc. Their variety and adaptation are striking.

39. *Variety by Settlements.*—Two cities only are of over a million inhabitants. There are not forty towns with over 100,000 population; and not four hundred with over 20,000; while the villages number more than 700,000. It may, therefore, be said truly that India lives in her huts and cottages.

40. 1. *Village, the Unit of Indian Life.*—The village has been the unit of Indian life from time immemorial; and the Village community led its corporate life under its Panchayats (the Council of village elders). Thereby, it was enabled to survive fire and sword to which it would be consigned. Scarcely would the despoiler

depart when it woud reform and re-establish itself and resume its life.

40. 2. *Villages, strengthening Cultural Features.*—To the villages is due no small share of the Stability of Indian Civilization and its Simplicity. Their self-sufficiency and their diffuse scattering over the wide spaces of India proved their salvation. Here, then, is a geographical cause (apart from intrinsic worth) for the survival, the continuity, and the antiquity of Indian Civilization.

40. 3. *Decay of Villages.*—Rulers came and Rulers went, but no one could hurt them all at a time; and the villages went on until very recent times, when internal decay began to set in and injure their vitality. The new forces of Modern India have contributed to the decay of villages, chief of which is the rise of towns.

40. 4. *The Indian's Village-Sense and Revival thereof.*—Yet so strong is the sense of village among Indians that there is yearning to reconstruct it. That is one of the planks of the Congress platform; and Wardha under Gandhiji is having a busy time of it.

41. *The Town.*—The aggregation of Villages makes the Town (e.g. Palghat, Madras). Towns have sprung up in the past as capitals (e.g. Delhi—there are seven Delhis, in ruins); as Governor's seats (Lahore, Peshawar); as fortresses (Multan, Gwalior, Bharatpur); as Holy Places (Benares, Gaya, Amritsar); as way-nodes (Dera Ismail Khan, Bezwada); as Sea-ports (Surat, Masulipatam, Calicut, Alleppey); as river-ports (Patna, Dacca); as market-towns (Hinganghat, Pollachi); as manufacturing-towns (Moradabad, Ludhiana); as camp-towns (Aurangabad), etc.

42. 1. *Variety in Sources of Power, Animal Power.*—The abundance of villages makes India take the leading place in animal husbandry. In the number of animals, their various kinds and their several uses, no other country comes near India.

42. 2. *Cattle.*—Cattle are the best used source of Power in India, next only to man. They are used to draw carts, plough fields, transport burden (they were mounts, too, formerly), raise water from wells, press oil from seeds, and do many an other duty in rural and urban life. Through them, waste straw and grass become converted into power; while yielding also food, as milk to the Hindu, as meat to the Moslem.

42. 3. *Cattle, in History.*—What made Tippu Sultan so formidable in History was his mobility through cattle, in days when

there were no railroads. Passing into British hands upon his fall, and annexed to the British Commissariat by Col. Wellesley (later, the Iron Duke), the Mysore cattle beat the Mahratta horse (at Assaye, *1803*, etc.) finally. Even now, the army makes large use of cattle.

42. 4. *Other Animals.*—Elephants are tamed to man's service and they carry men, pile logs, draw guns. The camel, horse, mule and donkey have a regional distribution.

42. 5. *The Horse.*—But the horse, save for the army as at Hosur, Sargodha, and the Canal Colonies of India, is not bred for strength or quality ; it does the humbler service of drawing ekkas, tongas, gharis and jutkas ; and its endurance is remarkable as in the Mahratta days.

43. *Variety in Culture.*—Thus constituted and provided by Nature, India developed a level of civilisation not behind that of other peoples of the world, from earliest times till XVII century. From the third century B.C. to the thirteenth century A.D., men and women of India, both Hindu and Buddhist, spread the Light of India's Culture far and wide over Asia's Mainland and Islands, from near Ceylon to distant Mongolia, from far-off Bokhara (= *Vihara*, same word as Bihar) to remote Borneo and Japan. It is amazing how, with only the Faith that moves mountains and none of the facilities now available, waves of such Cultural Missions travelled over barriers of virgin forests and gigantic mountain ranges, of formidable rivers and perilous seas, of alien if not hostile races, religions, and tongues—over barriers that are stupendous even under modern conditions. And the peoples of those countries looked to India as their Spiritual Home.

44. 1. *The Cultural Lag.*—A definite Cultural Lag has supervened since XVIII century, Europe outstripping India with Modern Knowledge and Power.

44. 2. *Thereby Europe, ahead of India.*—The Grand Monarch, Louis XIV, may be compared with the Great Mogul, Aurangazeb ; and the advantages are all in favour of the latter, save in the possession of loyal and able Generals, those of Louis creating and establishing the superiority of European Military Science and Service. That Superiority it was, which led eventually to the Supremacy of the British in India, who beat off their European rivals with their Command of the Sea. In the night that fell upon India in the XVIII century, the Mahratta held up the torch but contentedly dependent on borrowed helps (for example the French-trained Ibrahim Sahib

Garde at Panipat, 1761 and French soldiers elsewhere) missed the real source of European Power—Creative Knowledge. In these three centuries, XVIII, XIX and XX, Science and the Industrial Revolution with all their consequences have wrought in Europe a wondrous sea-change into rich and great power; and all the while, India has been fast asleep. Even to-day the value of Science and Creative Knowledge is dimly, if at all, realized in India.

45. 1. *Nature's Gifts to India, and Man's Use.*—We have seen how on the physical side, India is one of the countries best endowed by Nature; the gifts of her shape, situation and climate are an inexhaustible treasure. On the human side of utilizing them, men in India bring to bear their several gifts of knowledge, attainments, and varied culture; their caste (in the extended sense) creed and colour; their race and religion. And each takes his share of them in accordance with those dictates. Thus, the lucrative trade in hides and skins is a Hindu aversion but a Mohammedan occupation, though both the Hindu and the Mohammedan belong to the same place, say Vaniyambadi, and are at the same level of culture.

Even in this way Caste helps to diversify Indian Economic Life and to relieve pressure upon the same occupation in Static India, assuring its man a morsel of food and a chance to live by learning his caste trade and plying it. Hence also the clash of competition in fields of shrinking opportunities, occupations being limited in a Statical India.

45. 2. *The Static Level.*—The India of to-day has reached its level, from statical standpoint.

PART II—DYNAMIC GEOGRAPHY OF INDIA.

1. *Dynamic Geography.*—It is the province of Dynamic Geography to make an estimate of the forces that are or will be in operation; synthetically to see things together, and as a whole; and indicate their tendencies in the future.

2. 1. *India's World Relations.*—To begin with, India's World Relations fall under two heads, the Political and Non-Political.

2. 2. *The Modern World consists of three Groups.*—Under the dread power of modern weapons forged by Science and the Technicians, the Modern World is divisible into only three groups: potential Allies, Enemies, and Neutrals. None dare act singly.

2. 3. *Alliances sought.*—Neither Mr. Churchill nor Chauvinists can dare to plunge the British Commonwealth into a Prestige-war,

single-handed—catastrophe obviously waits on such an adventure. The British Commonwealth, too, has to seek Allies. Therefore, under modern conditions, what matters is, not so much what chinks in the armour there are, as what Alliances there are. Weak points in Defence are no more to be flung at India than at Britain.

2. 4. *India's Place in World Politics.*—India's place in World Politics is defined by her being part and parcel of the British Commonwealth. Its enemies are her enemies; its friends, her friends. Her King is the British King; her flag, the Union Jack; and she is under the protection of the British Navy and British Aircraft.

3. 1. *Isolation in External Politics.*—It follows that the Principle of Isolation, which has been described to be at work *internally* in Static India, is carried to completeness *externally* in the sphere of foreign affairs. By India's place in the British Commonwealth, World events cast their shadows upon her, only indirectly, through the British connection.

3. 2. *Non-Isolation Elsewhere.*—But in Non-Political Spheres, the great changes in the world at large, wrought by the Discoveries and the Conquests of Science, alter completely the Geography of EACH MAN'S Environment, especially by annihilating vast distances in time and space. They batter down the walls of isolation, both Internal and External, in Non-Political Matters. No longer can India lead a sequestered life, shut behind secluding frontiers. The Indian has for neighbours not merely the cottages of his village or the town ten miles off but the wide world itself.

4. *Remote Villages also linked to the World.*—By a Ford Bus, the remote villager can travel to his city a hundred miles away, transact business there, and return home by evening. To do so would have been an event of a lifetime before. And being where he is, he knows the prices current at distant Liverpool and remote New York within three hours of their settlement. The net result is, the villager is linked to the world. He may be in the heart of the Vindhyan forests or Himalayan mountain valleys. The narrow grooves of his former being have crumbled down. The world comes to him where he is, and knocks at his door; and he now looks on the world as his neighbour. (See also para. 21. 2, *infra.*)

5. *Caste also adapting itself.*—Like Isolation, Caste, too, has been feeling the impact; but such is its intrinsic vitality that it has been adapting itself to the varying demands of modernity. Not all

the power of Clive could save a caste clerk from being outcasted for involuntary defilement by meat being thrust down his throat by soldiers in a prank. Two hundred years, and what changes! At the annual Oxford and Cambridge Dinners at Calcutta, it is not unusual to find Indians form 30 to 40 per cent. who retain, for all their residence for years abroad, their pride of place in their Society.

6. *Self-Sufficiency broken into.*—It is in Self-Sufficiency that the New Geography finds the largest inroads. Formerly, in the villages, crops were raised for local consumption and life went on statically and at leisurely pace. Economic laws have brought more lands under the plough; crops are raised for cash more than ever before; new wants have sprung up; and the craving for comfort and amenities takes the place of the older contentment. (See also para, 21. 2, *infra.*) Migrations to towns are proceeding apace.

7. 1. *Attractions of the Modern Town.*—The multiple and complex Personality of Modern Towns generate centripetal forces that deplete their Hinterland-Villages of their men of light and leading; and others go thither in search of employment. The Collector's *cutcherry,* the Police Thana, Courts of Justice, Schools, Colleges and Hospitals, the Shop and Factory, the Rise of the Professional classes, Theatres Talkies and a hundred amenities of life, the wide chances of making a living (*fas et nefas*) or even of living on charity—all these modern causes act with compelling force. The Linking of Villages to Towns and of Towns to Towns by Bus and Lorry has quickened the pace. Deserted villages are resulting from all such causes.

7. 2. *The Growth of Cities.*—The City rolls out before one's eyes as a place of life and movement. The modern cities of British making represent and reproduce the Western World in India and vitally influence the hinterland towns and villages.

7. 3. *Calcutta.*—The capital of India has been shifted from Calcutta to Delhi. Calcutta, owing its rise to the British and its importance to its geography, nevertheless holds the first place in India not only as the city of palaces but as the city of capitals. Calcutta is the capital of tea, jute, coal, iron and steel, paper, and shipping; of Europeans in business; of Marwaris who are in all industries and finances; of University Developments; of Bengal Province; and of Bengalee Life itself.

7. 4. *Bombay.*—Bombay has the natural harbour that is nearest to Europe. Through the aspect of such situation, Bombay has risen from a small island to be the second city of India not

through the wealth of its hinterland like Calcutta, but by the enterprise of its citizens ; for, they include the leading trading castes of India (in the larger sense of caste). The Rajabai Tower in Bombay is adorned with figures representative of them and they are representative of Bombay. The Business-European, the Parsi, the Khojah Borah and Cutchi Memons, the Bania, the Bhatia, the Kathiawari, the Guzerati, etc., jostle with one another in the market-place and meet on equal terms at the Stock Exchange.

7. 5. *Madras.*—Madras is a congeries of villages that gathered round the Fort, or had been there, before ; and under its guns, secure from harm, it has grown by internal trade and external commerce. Its industrious and intelligent people provide officials, teachers, traders, clerks, coolies, etc. Its harbour, providing shelter on a surf-beaten shore and doing away with Madras Roads shows how the Spirit of Man (to wit, Sir Francis Spring, here) can transform Statical Geography.

8. 1. *Cultural Lag.*—There has been Cutural Lag. For three centuries, India has fallen behind. The leaven of new knowledge that leaveneth the whole lump of Europe has only recently begun to work in India.

8. 2. *The Universities.*—At the centres of knowledge—her Universities—until the end of the XIX century, the work in point of fact was only to produce men for jobs in Government service and the needs of administration, clerks and lawyers. It is only through the late Sir Ashutosh Mukherji and his work at the Calcutta University (from 1904 to 1924) that Universities are prepared to accept the ideal of, and make some provision for, creating and re-creating Knowledge. As observed by (the first) Lord Haldane, Modern Germany and Modern Japan have been made at the Universities, the latter without even producing any outstanding geniuses. In India, we are only just at the beginning.

8. 3. *Illiteracy Drive.*—All European nations set great store by Literacy ; and Japan, also, boasts 98% literates under the Meiji Scheme. In India 8% is the literacy. To liquidate illiteracy in the land is fraught with difficulties, both Geographical and Financial. The population is scattered in villages over wide spaces and by long distances ; they can be reached only with great difficulty by the Schoolmaster ; he, too, is in need of a living wage in a capitalistic world unlike his forbears who taught, on the pial, letters to village brats, in return for doles of rice and pulses, oil and fuel. To spend yearly about Rs. 100 only on a village for

education is to find 7 crores of rupees yearly, for all. Other problems of health, sanitation, malaria etc., are in similar case, conditioned by magnitude and multitude.

9. *Dynamic Geography emphasises Progress.*—The new Geography can emphasize how, armed with the strength and power of Modern Science, man in India can visibly raise the Levels of Production and by fair distribution mitigate somewhat the appalling poverty of the people. What other countries have done with the weapons of Science, it is open to the Indian to do, for himself at least, if not for his country ; for, even such self-regarding acts make Indian poverty by so much the less.

10. 1. *Illustration, the Old Geography of Japan.*—Statical Geography would describe Japan of eighty years ago as a typical Asiatic country improgressive, unchanging, doubly isolated by being insular and by isolating herself, and lost in a mediæval dreamy life.

10. 2. *The New Geography of Japan.*—Dynamic Geography shows how the Spirit of Man has made her outdo her European and American teachers. Rudely awakened by Commodore Perry's knock at her gate (1853) she has roused herself from her age-long sleep and has grown into their formidable competitor in world markets. She illustrates how one and the same Asiatic nation, with but Fifty Years of Europe, can pass by a Cycle of Cathay—at any rate, in material progress.

10. 3. *Japan, to-day, a maker of goods for India.*—Twenty-four years ago, Dinshaw Petit drew pointed attention to the singular fact that the Japanese ship in the Bombay Harbour unlades cotton goods and lades raw cotton. She buys pig iron and scrap iron from India and sells to India a hundred iron goods from pins to bicycles and galvanized iron-sheets.

11. *New Opportunities opening in India.*—The bread that such occupations give could be secured for the Indian, were there available technical and scientific knowledge that is real and true—and not merely Degree-ed—along with organizing ability and discipline.

12. *Other such openings.*—We may give examples of similar opportunities in the Dynamic Geography of India.

13. 1. *Agriculture.*—The tribute paid by Dr. Voelcker to the traditional skill of the Indian ryot holds good to this day. He leaves little room for improvement in his methods in crops within his range of experience. But in these fifty years since then, there

have been other crops to the fore; more lands are under tillage; the available water supply changes; new cheap manures (like sulphate of ammonia, activated sludge and town-refuse) have come to supplement the old, while the quantities available of the old are a shrinking factor. The proportion of cash crops to food crops and fodder crops requires constant adjustment.

13. 2. *Sugarcane.*—The Wizard of the Sugarcane at Coimbatore (Sri Venkatraman) has produced a cane for every variety of soil, water, and sun, enriching the sugar content and advancing the bearing time. The work of that Burbank has not yet been availed of by Indians in general, though taken up eagerly, to their profit, by the Europeans in Sugar of Bihar and the U.P.

13. 3. *Utilization of Land.*—In statical geography, the utilization of land has been carried out as far as possible in ancient districts like Tanjore and Patna. But on the dynamical side, we see new opportunities and new uses springing up. New vistas open through new demands, and demands for more and better stuff; for kitchen gardens and flower-beds in the hinter-land of growing towns; for groves of mangoes and cocoanut and jack; for fruit trees, nuts, oil-seeds, etc. The canning industry has not even struck root.

13. 4. *Utilization of Gain ; of Produce.*—And whatever is won from nature is often lost to man through faulty storage and wasteful marketing.

13. 5. *Future.*—The New Geography visualizes improvements all round.

14. 1. *Fisheries, another illustration.*—Fisheries are another illustration pointed out by Dynamic Geography. Fish is not so widely consumed in India as it may be. But fish is a staple food of forty million population of well-watered Bengal. There and elsewhere, the demand can easily be made to create itself and whatever demand there may be, can be met entirely and cheaply, too, by the abundance of fish in Indian Rivers, Lakes, Ponds, Tanks and Seas. The trawlers of Japan (which is, like Bengal, a greatest consumer of fish) visit the Indian waters also, among other Seas of the world. Modern methods of preservation of fish from the catch to the consumption such as cold storage, ice-packing, keep the fish fresh for the table. The riches of Bengal are manifest on the subscription day of Government loans.

14. 2. *Fishery, utilization-Entrepreneur.*—Here then is a case where Geography can point to the potential development and utilization of the sea-acres and water-wastes; where all necessary factors are convergent. The utilization awaits the coming of an entrepreneur, preferably of Bengal, failing whom, of Britain or Bombay, who may soon take up the matter. Such a man (or a Company) can serve Calcutta with fresh fish from Chilka Lake brought in three hours of the catch by air-plane and reap the rich harvest of the sea. The non-utilization till now has always been a standing wonder to the Geographer.

15. *Modern Transport, an instance.*—Transport furnishes an instance where the opportunities are great and the problems are partly geographical, partly economic. Already, the Railways of India with their 41,000 miles of roads hold the third rank in the world though they do not as yet, make their own locomotives; and they can be expanded sixfold; so large a part of the country remains unserved by Railway.

16. 1. *Railways.*—Railways have created new life and culture where they traverse.

16. 2. *Railway in Andhra Country.*—The Andhra country throbs with new life, thanks to the East Coast Railways (now B.N. & M.S.M. Rys.) connecting it with Calcutta and Madras in the last forty years, and thanks to the modern irrigation projects of the Godavari and Krishna Anicuts.

16. 3. *Railway and Kerala.*—Shut up between the mountain and the sea, Kerala has been preserving many an ancient custom like the Hinduism of the Nambudris, the Impartible Joint Property (Tarwad) and its Laws of Descent. Before the Railway, the Malayalis used to lead a clean simple placid life with the simplest and best marriage laws in the world. The Railway has transformed completely their dress and manners, their outlook and life. Like Scotland, Kerala is the land of the mountain and the flood; like the Scotch, too, in education and thrift, the Malayalis have diffused all over India within the last forty years, thanks to the railway which has broken down their isolation.

16. 4. *Effect of no Railway.*—No Railway penetrates Nepal and Garhwal in the Central Himalayas, where Hinduism took refuge. Nestled in their mountain fastnesses, the Nepalese and the Garhwalis cherish their Independence and their Religion and preserve their customs unaltered. The Nilgiri Railway, on the other hand,

has brought in Modernity and has seriously affected Toda (Mountain) culture, along with other causes.

17. 1. *Motors.*—In this century of Motor Car, Lorry, and Airplane, the last has great scope in the great distances of India, but will have only a weak development, unless Imperial necessities prescribe a large expansion. But the motor car and the lorry have been spreading phenomenally (thanks to Ford) and opening up the countryside and urbanizing the Villager's outlook.

17. 2. *Expansion.*—Less than 2 lakhs of motor vehicles are in India but even this number is to be checked so as to help up the falling Railway Revenue in which the State is interested. Unlike the case of flesh-drawn carts and waggons in Static India, the Railway and the Motor Car create their own traffic and swell its volume. The new opportunities are being fully availed of.

18. 1. *New Sources of Power.*—We have seen how Static India moves on Animal Power (Pt. I, 42. 1.).

19. *Coal.*—Coal has been found and used but the distances from the pit-heads of Giridih, Jherriah, Raniganj or Barakar are so great as to place it out of reach of many of a place in India.

20. 1. *Water-Power.*—Water-Power, where available, makes up somewhat for that. By virtue of Relief, the waters of India in their journey from their source to the mouth, carry immense possibilities of generating Power. With every development of Hydro-Electrics in the world, more and more of Indian waters are harnessed.

20. 2. *The Cauvery.*—Cauvery Falls at Sivasamudram was the first place to be installed in India ; the Cauvery itself has been made to yield still more power at Krishnasagar Dam higher up, and at Mettur Dam lower down ; and there are other places higher up as in Coorg where the same river can generate more electricity.

20. 3. *The Pykara.*—The Pykara River on the Nilgiris has been dammed and electricity is supplied from it to many a District up and down.

20. 4. *Others utilizable in South India.*—Gersoppa, the highest falls in India, is about to be yoked. The Adab in Jeypore State in Ganjam (Orissa) can be put to similar uses. With such 'white coal,' South India makes up for want of Black Coal and can meet all her requirements in Power ; and she can grow 'green' coal, too,

20. 5. *Power and Industries in Mysore, Model for Future.*—A series of correlated industries has sprung up in Mysore, an augury of things to come in India through or under State auspices. To work Kolar Gold Mines, the Cauvery Falls was made to generate electricity, and Power transmitted on a 92-mile line (then the longest in the World). The Krishnaraja Sagar Project developing more power brings water to a lakh of acres and a quarter. Still more Power is to be got from Gersoppa Falls. The Installations meet the urban and rural requirements in Power of Bangalore and Mysore and increasing circles of villages. What is remarkable is the correlated series of making electrical goods in Mysore State to cope with its electrical expansion; porcelain cleats; electrical bulbs; glass (through Ogale); small electro-motor parts, etc. Forest Wood is treated for Posts and Pylons with Creosote obtained as by-product in the making of charcoal for the great Bhadravati Iron and Steel Works. Chemical industries are springing up for fuller utilization of by-products. Paper is made at Bhadravati. The Sugar Factory at Mandya is correlated with the sugarcane and the wet acres of Krishnaraja Sagar Dam. The near future may witness Mysore Aluminium and Mysore Silk built up by Science and not propped up by Tariff Walls.

21. 1. *Effect on life.*—Their effect on activities of life is striking. Already, in Mysore, Electricity pumps water for irrigation, works rural industries; it lights the streets and the cottages, and runs the radio. Mysore is coming to every villager. With amenities thus provided and the Ruralization of Urban occupations, at the same time that town life is costly, the villager may after all stick to his village, resisting the spell cast upon him by Town. Here is a Harbinger of the Future.

21. 2. *Isolation outlook going out.*—The villager is rapidly losing not only his Physical Isolation but the Isolation-Outlook. The old simple, self-sufficient and contented life of the village is enlarged and made fuller under modern conditions. Should this prevail, it may retard the Town-ward migrations of people.

22. 1. *Occupations.*—Occupations in Static India have reached a stationary level. But in Dynamic Geography, they are subject to continual change. With every advance of knowledge and activity in the World, India cannot help undergoing corresponding changes.

22. 2. *World Progress—on Indian production.*—India furnishes the most striking examples of Dynamic Geography, in

the consequences that have resulted to her Indigo, Sugar and Cotton, through the changes wrought by the spirit of man working *upon matter. From early times* until the nineties of the last century, Indigo was one of the principal sources of India's Wealth. The German Chemist in his laboratory learnt to produce cheap Aniline (Al + nil = The Indigo) colours from Coal Tar; and Germany has driven out Indian Indigo from the Indian market itself which now absorbs crores worth of German Dyes. Sugar Beet, also perfected by Germany, beats the richer yielding Sugarcane; Java, producing and marketing Cane-Sugar, supplies India, too (now, only in part). Cotton goods come from abroad to India which, till 70 years ago, used to send them abroad.

22. 3. *Village artisans.*—As if there has been little change in the world, the old time artisans of the village—the carpenter, blacksmith, goldsmith, weaver, potter, etc.—ply their precarious craft with many, many ups and downs.

22. 4. *Industrial Revolution.*—The situation is like that which arose in England upon the establishment of Industrial Revolution. Large numbers in particular industries were thrown out of work but they were re-absorbed in the expansion of Workshops and Factories that followed the first burst, which took the world by surprise. On account of being the first, Britain became the workshop of the world. But the Unemployment due to one machine doing the work of tens of people fell upon the countries where the British marketed their output, of which India is one. The men thus thrown out of employment in India have not yet been re-absorbed in new occupations, as happened in England. The old occupations are gone and no new ones have taken their place. Even the expansion of factories in India has only increased, and not diminished, the process of throwing out the village spinner and weaver, so long as the factory output is only for the Indian Market. These remarks refer to the textiles in cotton and wool, which are the leading industries of India. The case is otherwise with other major industries—such as railway workshops; iron and steel Works; leather and paper factories.

23. *Industries.*—To meet the demands of the great market of India, Western modes of Production are copied; factories have been established and are springing up for Textiles in Bombay, Ahmedabad, Sholapur, Cawnpur, Calcutta, Howrah, Coimbatore, Madras; Railway workshops in Bombay, Lahore, Jamalpur, Perambur, Golden Rock, Asansol; Iron works at Bhadravati and Jamshedpur;

and so on. But these provide occupation for only a very small percentage of the population and not quite commensurate with its growth.

24. *Cement.*—Cement is the first and only industry to achieve self-sufficiency for India, taking advantage of Post-war conditions and making use of materials all of which abound in India. And it is sold cheaply, too, thanks to the competition of the Dalmias with the Dinshaw Combine (Oct. 1938).

25. 1. *Mines.*—Coal mining is ill-organized and not all of the mines are flourishing; but it employs many hands. Manganese ore is a principal export at Vizagapatam; Nellore and Hazaribagh mine mica; Gold-mining in Kolar is a wholly European enterprise. As for potential mineral wealth,—already, in 1910, Sir Molesworth spoke of its self-sufficiency in the Indian Empire. The Hammer of the Geologist has picked, since then, many an other mine and mineral; and, in the light of such finds, he can make the same affirmation of it, today, even after the present Separation of Burma from it. Furthermore, India is said to be the sink of metals; and, as is well-known, it is India's Hoarded Gold that has rallied the British Sterling during this decade when it fell off the Gold Standard.

25. 2. *Tanning.*—The tanning of Hides and Skins is done as in the olden time (even at that, the oil-tanning has gone out of use). There is, therefore, a virgin field lying open in the making of High-Class Tanning and Finished Leather goods.

26. 1. *Flow of Capital into India.*—Under the Protectionist Policy of the Indians that are gaining Political Power, there may well be a flow of capital, more than ever, from Abroad into India, with her cheap and long-houred labour, despite sporadic strikes, e.g., Dunlop; Lux; Bata; Wimco; Imperial Tobacco.

26. 2. *Gandhiji's Emphasis on human values.*— The Gandhian epoch emphasizes the value of human things and would rescue man from being swamped by machine. But it has not made headway: the Factory is winning.

27. *The Internal Trade.*—The Internal Trade of India is all-important. It is estimated at fifteen times the External Trade and is capable of great expansion. It may be confidently expected that, with increasing facilities for Yields and of Transport, more occupations will be found and more mouths fed.

28. 1. *Agriculture.*—The chief occupations remain therefore centred round agriculture; more and more, there may develop

dependent industries engaging many hands. The entrepreneur *for them is yet to find his place.* At the present time, the urban youth or the urbanized villager, willing to turn his hand to industry but disdaining rural toil, enterprises to produce urban goods as they may be called in India, soaps, candles, toilet articles, etc., in competition with Germany, Japan, France and England. Land finds no place in his thoughts.

28. 2. *Disequilibrium by Political action.*—Even in agriculture, world forces are at work that may disturb the disequilibrium still further. India pays England her dues not by selling all her goods to England but by selling largely to other countries of the world ; and paying from out of such receipts. Economic Nationalism, Ottawa Preference, Barter Systems and Tariff Walls have each its reaction upon Indian agriculture and prosperity.

28. 3. *Disequilibrium by New Producing-countries.*—Secondly, the produce monopolies (absolute and real or virtual by reason of quantity) will be destroyed in the future. Already, jute has been successfully grown in Africa by Indians taken thither, and in a decade African jute will cut Bengal jute. Cotton is a necessity for War as well as Peace; and Soviet Ferghana, under the Five-Year Plan yielding excellent cotton, has been linked to the Central Asian Railway and commands the West Asian markets, which were once supplied by Bombay. Italy is to raise cotton in Abyssinia and Germany pants for similar lands. British Africa has been growing cotton successfully.

28. 4. *Disequilibrium by new Production in India.*—Thirdly, the disequilibrium will be accelerated by large extensions of production in India herself. Among the great wheat and cotton areas are the snow-fed Punjab, and the rain-fed Central Provinces and Berars. Sind under Sukkur Barrage will yield within a decade wheat and cotton equal to those of Egypt in quality and quantity. That is bound to cause a great dislocation in India herself as well as foreign markets and the internal competition may push the rain-fed C.P. and Berars to the wall.

29. 1. *Caste and Occupations.*—In Static India, occupations have followed caste (in the larger sense); in the future, caste will follow occupations. The Great War has been a great solvent, and has forced the pace. Caste has fitted itself into the variety of occupations and into different parts of the same occupation and *vice-versa.*

29. 2. *Specialized occupations.*—Since the division of occupations in India as a matter of fact has been by caste, each caste plays

its specific part in Indian Economy as a whole. For example, the semi-nomadic Thoru caste do pioneer work making clearances at the confines of the Terai; and cultivate the patches; upon such lands, other castes of settled life settle shortly after; and the Thoru leaving them goes farther into fresh Terai; and so on. A similar progression of castes happens at the Doab where the peneplains are extensive, 20 to 25 miles broad at places, and clothed with rank jungle vegetation. Likewise, in Bombay, the British may lead in, the motor parts trade; the Parsi comes up followed by the Moslem and then by the caste Hindu; and finally comes the Marwari, with whom none can compete: he cuts his margin so fine.

29. 3. *Specialized even in the same caste.*—A man of one occupation will not take up that of another: 'The palanquin bearer would not tie the calf;' 'The potter would not serve for barber'. Every European in India can speak to this from his domestic service, where a servant of a certain designation will not do the duties of another—even though all may be of a caste and the work unskilled. (Cf. *Chhatri-ka-Naukari*—it is not within the bond for a servant engaged to bear umbrella to lift up a falling child).

29. 4. *Man finds his level.*—Thus in India a man, enabled to find his level, his occupation and his work, is at it with rigidity if he can, under caste-forming tendency.

29. 5. *Parsi creates new occupations.*—Turning to the casteless caste: Small in numbers, the great Parsi community have been pioneers of Industrial Progress, and latterly, of Finance. Their benefactions and munificence are well known. By their high education and traditional instincts of commerce, and freedom to go abroad, they have been the first to see the possibilities of new things and to seize the opportunity as Captains of Industry. They have been the pioneers of Mills in India, capturing the Levant and China markets (both of which India has lost); of Western Hotels in India (the Taj Mahal Hotel); Iron Works in India (Jamshedpur); Aviation in India (Tata's); Cinemas (Madan); Safe-making (Godrej and Boyce), etc. Sir Jamshed Jeejeebhoy, the Jehangirs, the Tatas, the Petits, the Camas, the Wadias, Dadabhoy Naoroji, Pherozeshah Mehta and Wacha are but a few names out of those Parsis that have enriched India. The last three are household words in Indian Politics.

29. 6. *Parsi's Service to India.*—To find new occupations in Modern India, to show the way by their exertions and example and to be munificent with their earnings—that has been the

service of the Parsis to India. No other community in India has covered itself with greater glory than this small Parsi community who claim no special privileges.

30. 1. *Selection by each Province made from British Examples.* —It is very remarkable that in the exchange of thoughts and ideas due to the British and Indians coming together, the attractions of each province have been to those aspects and sides of the British in India, which correspond to its own peculiar bent.

30. 2. *By Bombay.*—Bombay, devoted to Industries and Commerce, has been impressed with the British merchant, is close on his heels, and runs him hard.

30. 3. *By Mahrattas.*—The Mahratta, with memories of having been the last great Ruler of India, rises equal to the British in Diplomacy and Politics and the Art of Ruling.

30. 4. *By Madras.*—Madras, keen upon things intellectual, is impressed with the British Scholar and Ruler, and has turned out Scholars and Statesmen.

30. 5. *By Bengal.*—Dynamic Bengal, her thoughts and creative power turned upon politics, society and religion, has been impressed with British leaders of them, and has created New Faiths, and Modern Indian Politics and Society. Bengal is the laboratory of Politics in India and has given the lead in Science

Such tendencies forcibly bring out Regional peculiarities.

30. 6. *By Railways.*—Likewise, the Railway Administration though run by the British, display similar regional differences.

31. 1. *Cultural Contacts.*—Geography and History show that different peoples cannot long live together side by side without their influencing one another in the several walks of life; only the influence comes out visibly on the surface of each according to its degrees of susceptibility.

31. 2. *Hindu and Moslem.*—The Moslem and the Hindu have been living for centuries not as two nations but alongside each other in the same town and village. The influence of Islam on Indian culture has been notable, not only in Religion and Politics but also in Painting and Architecture, in Social Manners and Customs, in Language and Literature.

32. 1. *Painting.*—Hindu and Buddhist Schools of Painting have been followed by the Rajput. And the Moslem School,

irst deriving from Persia, shows an Indian evolution in strength f drawing and treatment of atmosphere and composition, as well s in differences of Symbolism and Realism. Amarendra Nath 'agore has founded the Bengal School while new schools are forming, guided by the Late E. B. Havel, Messrs. Percy Brown, Gladton Solomon, and Yazdani.

32. 2. *Architecture.*—In Architecture, the Hindu and the Buddhist have attained pre-eminence in Temple building which nay be seen in the Geographical diffusions from Kabul (the pillar; Bamiyan) to Indo-China (Angkor-Vat); from Java (Borobudur, 'rambanam) to Japan (the Toru, for example). And from the Hindu Kush, that influence travelled Westward into Persia and Asia Minor.

32. 3. *Hindu Remains.*—In Sculptures, and treatment of figures f animal and plant life and arabesques, in gates and pillars, towers, dornment of capitals of buildings, a continuity may be traced from Gandhara under Greek Influence to Mathura, Amaravati, Barhut, o the rock-caves of Ajanta and Ellora, the Raths of Mahabaliuram, the Chalukya bejewelled Star-pagodas, the Vijayanagar 'emples and Towers.

32. 4. *Moslem Remains.*—Moslem Greatness is writ large in Sikandra and Fatehpur Sikri, the Taj Mahal and Pearl Mosque, umma Musjid of Delhi (and its cities in ruins) Badshahi Mosque f Lahore, Goli Gombaz of Bijapur, the forts of Agra and Delhi, he Kutub Minar, etc.

32. 5. *Blended influences.*—The Indian Moslem buildings of ndia and Central Asia are interesting blends. Those of Agra and Delhi are modelled in shape and form, upon Samarkand and Bokara, to which, the Great Timur took as his booty from India fifty housand workmen from Delhi and which he adorned through hem.

32. 6. *British Buildings.*—British India, building under the tilitarian philosophy of XIX century, has to its credit not these ut Barracks, the Thana, Cooly Lines and Factory and Cutcherry. 'he Victoria Memorial of Calcutta is Curzon's attempt to make up or the omission of ornamental buildings.

33. 1. *Dwelling Place.*—The evolution of the dwelling place, which, in the nature of things, responds definitely to regional georaphy, has not yet been studied and leaves a gap to be filled by eographers. The modern influence is everywhere visible not only

in the wide choice of material but in the style itself; even so, there is a great uniformity in the hut and cottage, characteristic of places and regions.

33. 2. *Mitigation of Heat.*—It is very hot in the hot Season. The Seista, that noon-tide pause in the day's rhythm, is the common Indian's device against heat, save where he is in office under the eye of the master. In building for habitation, it is a common design in India to have less light and more air: to have *cool currents* of air.

33. 3. *Mogul Palace.*—The Mogul in building his Palace designed it to mitigate the heat of the sun;—the long wall to break the current of air; the garden; the water-channel and the playing fountain trained into the inner court, too, for inner apartments; the long verandah; the thick walls and double walls to retain the cooled air; and the Punkah to keep it in motion are his well-known devices.

33. 4. *British Bungalows.*—What was possible only to Princes has been available to the ordinary Britisher in India with whom the Solar Hat, the Lounge Chair and the Bungalow are associated. The Bungalow (so called after Bengal by the Portuguese) is built, so as to obtain cool currents of air, with long verandahs deep and cool, the air being passed through water-sprayed Khus-Khus curtains by the Punkah-puller (now being displaced by the Electric fan or Jost Fan). With the coming of air-conditioning, yet further stage is reached in comfort.

33. 5. *Town-Planning.*—Town-planning has a long history in India. Mohenjodaro of 3000 B.C. shows appreciation of Sanitary Science which in modern Europe dates from Chadwick's work in England in the forties of XIX century. The Town-planning of Conjeeveram and Srirangam, also indigenous evolutions, has received Dr. Patrick Geddes' esteem. Towns of Modern India are planned entirely by the British. New Delhi and Dacca (Ramna) are examples. Taxila and Nalanda are ancient university Towns whose ruins show thought and plan.

33. 6. *Modern Extensions of old Towns.*—Every old town provides itself with new Extensions on modern lines. Modern Mysore and Lucknow are beautiful extensions.

33. 7. *British Cantonment.*—While several old towns in Pre-British India are only tented camps made permanent, the British

cantonment is a new feature; and the British segregate and build these towns as a series of Bungalows on long lines.

34. *Difference: Britain and India.*—The difference between Chowringhee and Chitpur (both in Calcutta), said Tagore Babu once, is the difference between Britain and India, between the community service and outlook of the one and the other.

35. *Society.*—In Social manners and customs, there has been an evolution of a common code of manners, graces, and courtesies of life, which is commonly observed.

36. *Non-religious matters.*—On the non-religious sides, Moslems and Hindus lead a common life in many places; a whole treatise has been written of late by Dr. Hamid Ali, M.A., LL.D., Barrister, Madras, on the Non-Islamic usages in non-religious matters among certain Islamic folks in India.

37. 1. *Music.*—Music is an art where Moslems and Hindus have attained unity. The great Akbar himself used to be enchanted by the divine art of Tan Sen. Indian airs and melodies soften the stern warriors of Afghan valleys and the Hindu Kush. South India has perfected its Music of Ragas; and that is the common heritage of Telugus and Kannadigas, Tamils and Malayalees. North India has evolved a similar perfection.

37. 2. *British Music.*—In the sphere of music, the British have nothing in common with Indians. Under British influence, Orchestra is coming into vogue; and British Bands and Bagpipes often play at Indian festive occasions.

38. 1. *Hindustani.*—Hindustani developed as a medium for the intercourse of two armed camps (Urdu=camp, same as the word, Horde). The British also have contributed to its growth. Despite the controversies over vocabulary and script (though all the scripts are foreign to India), the language understood by the largest numbers in India has a great future.

38. 2. *Indian Literature.*—That Literature has both Hindu and Moslem writers; the late Sir Mahomed Iqbal was one of the foremost Poets. Although there are fifteen Indian literary languages, there is a large body of common thought and theme underlying them all. English Literature, acting upon Indian Languages, has made their Modern Prose anew and given them Modern Outlook.

39. 1. *Indian Reactions to the British.*—The British and the Indians live apart in India; but there are mutual reactions all the same. Armoured in the triple brass of caste (in the larger sense) —Marriage, Food, and Occupations—the Indian may think himself untouched by foreign influences; but he has been responding to them, inwardly, all the while. The Britisher in India stays as Ruler but he is regarded also as the representative of the multi-faceted and highly complex Western Civilization; and Modern Ideas and Ideals have filtered to the untravelled Indian through one or other of such facets. To modernize after the European mode is, perhaps, a world impulse that is being witnessed from Istamboul to Samarkand; but the pulsations of new life in India are due to the symbiotic life with Britain.

39. 2. *Type to Type.*—Different types of the British have come to India and have created corresponding Indian types.

39. 3. *Ruler.*—The Ruling Briton, the I.C.S., and other officers, took up the then existing system of administration as moulded by Hindu, Moslem, and Mahratta, and made it efficient; so that in many districts, the courts, laws, and institutions are wholly British but administered by Indians entirely, without a drop of British Blood being found necessary.

39. 4. *Teacher.*—The early teachers of Letters and Science were British, and so well did they do their work that Macaulay, were he alive, would rejoice that his hopes were getting fulfilled in that India could flaunt already five Fellows of the Royal Society and two persons crowned with Nobel Laureate (Tagore and Raman), an honour to which Asia from Turkey to Japan and Africa from Cape to Cairo have not been called as yet.

39. 5. *Soldier.*—The British N.C.O. has drilled the Indian Sepoy to equality with his British comrade in all respects except food, uniform, and pay.

39. 6. *Business-man.*—Setting up in business, the Britisher, though working for his own hand, has shown how to organize business, erect factories and run Banks, build railroads and direct shipping; and the lessons of his success have been by no means lost upon vigilant Bombay in particular, and India in general.

39. 7. *Missionary.*—The British Missionary has stimulated Spiritual India to canalize its humane emotions so as to render acts of Social Service as practised in the West and adapt the ancient charity of India to such new modes.

39. 8. *The Professional.*—The British Doctor and Scientist, Engineer and Lawyer, successfully practising their lucrative professions in India, have set up high standards of *honour* as well as *efficiency*; and they are the accepted standard for their Indian brethren.

39. 9. *The Planter.*—The British Planter has triumphed against Nature; but the conditions of his success are beset with too many difficulties for Indians to follow, or compete with, him. The Epic of the Tea Garden has scarcely been told. To 'open out' a tea garden means to go out into the wild jungle, making a working team of heterogeneous hundreds of wild and aboriginal tribes and hillmen; to be remote for months from the Doctor and from civilized society of their own kind; and to take the risks of being cut off in one's prime by blackwater fever and other diseases which make no difference whatever between European and Indian. Here is a good example of Dynamic Geography showing what can be achieved under Modern Conditions.

39. 10. *Companies.*—Great Companies like the Imperial Tobacco Co. show by their operations at Guntur how the land there may, by its being made to yield its best, sustain not only the ryot but a highly paid staff for technical skill and supervision. That is an object lesson to India. Similarly, Spencer's at Dindigul, famous for Cheroots. Such examples show what room there is for development in India even in agricultural industry.

40. 1. *Anglo-Indians.*—The Anglo-Indians have also been an object-lesson. When Indians were not to be had, they were the Teachers, Higher Clerks, and Doctors and Nurses; and even now they prove their worth, by Discipline and Efficiency, as Police Sergeants, Telegraphists, Wireless Operators, and in Railway Service.

40. 2. *Other Europeans.*—Other Europeans have brought to bear the components of their civilization on Indian Life. Especially so are the Missionaries of Europe and America, and the Salvation Army.

40. 3. *German Technicians.*—And one of the greatest factors in building up Indian Industry to-day is that German Technicians are available, *ready to work under* Indians *and to teach* Indians, and *make up*, with their technical knowledge and skill, the want of Indian Technicians and necessary Knowledge—as at Bhadravati.

40. 4. *Kind of Westerners Received.*—In the XVIII Century, it was the Soldier of Fortune of the West (De Boigne, for example,

the prototype of Major Gahagan) that was welcome; in XIX, it was the Businessman; in XX, the Technician of the West is in requisition. Each age chooses according to its needs.

41. 1. *British Institutions.*—The British have brought with them their Institutions into India.

41. 2. *Club, etc.*—Besides the Club, which is as distinctive as exclusive, there are Gymkhanas, Race-courses, Golf-links, Yacht Clubs, Regattas, Pig-sticking Clubs, Tent Clubs, etc.

41. 3. *Sports and Games: Hockey, Cricket, Soccer, etc.*—Sports and Games, and Exercises to keep a man fit, even such as are peculiarly British, have gained ground among Indians. In Hockey, India with the Wizards of the stick (Dhyan Chand and Rup Singh) has beaten the rest of the World in successive Olympics. In Cricket, individual excellence has been attained though not as yet the team spirit (as the last Vizy Team to England showed when there was reversion to Indian conditions). In Football, the Mohan Bagan is the Arsenal of India. In Wrestling, Gama has an unbeaten record.

41. 4. *Indian Exercises.*—Indigenous Akharas have receded, coming out only on Moharam or Ganapati Festival; though they, especially with their Indian clubs and Leijums and sticks, swords and Dhand, have been spoken of as highly efficient.

41. 5. *Indian Contribution.*—The Polo, the Chess, and indirectly the Cards, are India's contribution to the world. Old time amusements like Hawking and Falconry (save Cock-fighting) are almost things of the past.

41. 6. *The Sporting Spirit.*—To play the game in the right sporting spirit is one of the hopeful and unifying agencies of the future.

41. 7. *Similarly Science is unifying.*—Education in Science, which recognizes no racial or communal, or even provincial or religious boundaries, is another cementing factor in New India. Science and Sports open a vista of hope for India, bitten as she is all over with many a virulent poison.

42. *British Reaction to India.*—On the British side, Life is not without its tolls to pay. The only European in the heart of a forest, the Britisher goes through the rites of Tea-drinking as at Home, under dread of losing form. The Nabob of olden time, also under similar dread, drank his magnums and wore his broadcloth in broiling heat, at the same time as he adopted the Hubble-

bubble and mulligatawny and (Becky Sharp's) green chilies. The Jos Sedleys and Touchwoods are gone, even the Colonels Mannering and Colonels Newcome. But in spite of cheap and frequent passage home, many a man has to sacrifice his Family Life and Footing in English Society at the call of Imperial Service. They are, in the necessities of their position in India, further subject to the Twin Process of Isolation so as not to be mixed up in Indian Society and of Caste in disdaining humble toil. There must be black sheep even in the white flock, and not all that came to India have been white. But on the whole, the white have outnumbered the black.

43. 1. *Any Britisher 'Does.'*—It is a remarkable fact that any ordinary man of England could come to India and carry on, to the profit of both countries The disparity between Mediævalism and Modernity, the Cultural Lag that still lies between, accounts for it but partly. It is to the spiritual side of man to which that should be ascribed, though they came for wages, worked for wages, and took their wages. A shoemaker, and a bookseller, an incomplete printer and a watchmaker (Carey, Marshman, Ward, Hare) urged by missionary zeal and social welfare learnt and mastered Sanskrit, Persian, Hindustani, Bengali, wrote the grammar, provided those languages with the first printed literature, setting up Printing Press and cutting types, learning that Trade, when they felt the need for it, by their own unaided efforts here (which they had not learnt at Home). South Indian languages owe a similar debt to foreign missionaries like Beschi, Fabricius, Rothler, Kittel, etc. Science is indebted to Roxburgh, Drury, Day. Ross and Haffkine have won world fame by their work in India. The science of Modern Geography begins with Rennel's Hydrographic Survey of Indostan, more than 150 years ago.

43. 2. *Nicholson.*—Sir Frederick Nicholson I.C.S. (Madras) was notably full of the Geography of his charge from his salad years up. As early as 1892, he set out the Land Mortgage Bank Scheme, as a means of relieving Rural Debt. He was the author of 'Land Revenue Policy' issued by Lord Curzon's Government. Upon retirement, he settled in Kotagiri and worked, harder than ever before, for Indian Ryots. His administrative experience stood him in good stead, and he looked to the business side as well. He was the father of the Co-operative Movement in India. He travelled to Japan for study; and had the Fisheries Department, Madras, constituted, to increase the available Food supply; and produce fish guano and fish oil. He brought back also ideas on Elementary Education. He had the Kerala Soap Factory founded and the

Canning factory established at Calicut and a factory for Jam at Coonoor for instructional purposes. His last efforts were directed to increasing fruit production by carrying on propaganda to exhort everyone to plant at least one fruit-tree a year. At the same time, he was doing his bit at the municipality. All this he did in his advancing years. He loved the land he lived in and worked in; and laid down his bones there. What a noble and inspiring record! Every province can show such salt of the earth.

43. 3. *Chatterton.*—Sir Alfred Chatterton could not rest content with the routine duties of Engineering Service, Madras. He saw the room there was for the development of small industries and made Government do experimental work in Chrome Leather and Aluminium, and had those Works started, the first of any in India. He had the fly shuttle brought in to improve Handloom Weaving. Passing over to Mysore, he helped in the founding of Sandalwood Oil Industry there. His career shows what one man with the Will can do, and make new openings, even when such things are not within his own skill or within his bond.

43. 4. *Hailey.*—Lord Hailey has stated how in the junior years of service he obtained a biggish farm to carry out agricultural experiments, at his own cost; and casting about for manager, secured the services of a retired Tashildar whose agricultural qualifications like his own were nil. But zeal and honesty more than made up for want of knowledge: and Sargodha Farm served the Punjab as second only to Lyallpur.

43. 5. *Brayne, Calvert.*—The work of the Socrates in an Indian village at Gurgaon is watched all over India with interest. Sir Calvert has carved a name for himself in India by his work in Co-operative Societies in the Punjab.

43. 6. *Cotton, Cautley.*—By the genius of Sir Arthur Cotton and of Sir Proby Cautley, who had a geographical vision of Irrigation and started the Works, India has the largest system of Irrigation in the World.

44. 1. *Seshadri Ayyar.*—Happily, even in the field of Industry there have been Indian Leaders. We may give a few examples. Rising from clerkship in Mysore to be its Dewan, Sir Seshadri Ayyar, a born Engineer and man of action, electrified by the harnessing of the Niagara, at once set about picking his way through electrical knowledge; explored the Falls of Sivasamudram; and, in the teeth of expert opinion, installed the first Hydro-Electrical

Works in India. His mind full of the Dynamic Geography of Mysore, he built the Marikanave Project and had many an other scheme to put through.

44. 2. *Visveswarayya.*—Sir Visveswarayya, a certificated Engineer, has to his credit Krishnaraja Sagar Project and the Phadravati Iron Works. His bible is the Statesman's Year Book and the Abstracts of Indian Statistics. Best understood in U.S.A. and highly esteemed in Industrial Bombay, he has his plans of Reconstructing India and his latest work is to avert the Mahanadi floods; and to make the Car in India.

44. 3. *J. N. Tata.*—India has not produced in the sixty years past a greater name in Industry and Patriotic Philanthropy than Sir J. N. Tata. His Dynamical Geography it was that gave him expansive thoughts. The story is told of how observing from the windows of his Railway Train the long lake at Sitabaldi, his swift mind seized on its potentialities; and he had the Empress Mills built at Nagpur, the largest textiles in India for many a long day. His mantle fell on Sir Dorab Tata and Sir Ratan Tata who have built Jamshedpur and the Tata Hydros, and pioneer Civil aviation.

44. 4. *Harkishen Lal.*—Opinions may be divided about the late Lala Harkishen Lal's misfortunes, but there can be no doubt about the service he rendered to the Punjab and Upper India. While eating his dinners in London, the Dynamic Geography of the Punjab was always before his eyes. While there, he studied the Banking System of Germany and England; and on his return, he built up the People's Bank with moneys obtained on English banking system and Investments on the German model. He introduced Big Industries and Big Banking into the Punjab. Though his days ended in thunder-storms, the tribute paid to his work by the present Premier of the Punjab is as just as true.

44. 5. *Fazli Husain; Ashu Babu; Mehta.*—The late Sir Fazli Husain shares with the late Sir Pherozeshah Mehta and the late Sir Ashutosh Mukherji the fame of being Indians, who combined in the highest degree executive talent with far-sighted Statesmanship.

44. 6. *Mookerjee; Ganga Ram; P. C. Ray.*—Romantic was the career of the late Sir R. N. Mookerjee of Bengal; as also of the late Sir Ganga Ram of Lahore; and Sir P. C. Ray among scientists, with the dedicated life of a Rishi of old, produces Chemicals and Chemists—both. Several of his pupils have filled the Science Congress Chair.

44. 7. *Political Leaders.*—Indian Politics has attained distinction with its galaxy of brilliant Leaders and Statesmen—Chittaranjan Das and the Nehrus; Bullabhai, Jinnah and Azad (to mention only a few recent names) as well as Malavyaji and Gandhiji.

45. 1. *Room for Improvement.*—A dispassionate examination from the standpoint of Dynamic Geography of India discloses that the Wealth of India in Agriculture, Forestry, Fishery, etc., may be multiplied and applied to the reduction of the Appalling Poverty of Indians. The more one observes and examines, the more one is confirmed in the belief that the Utilization of things in India is far from complete; that the disabilities are more human than physical.

45. 2. *Dayalbhag Experiment.*—Under the impulsion of religious background, the Dayalbhag colony produces marketable articles of excellence unobtained before (as certified to by Successive Viceroys). Here, Religion has put down the disturbing elements, furnished the cohesion and the discipline, and has ensured the quality. Religion has furnished the central authority—but all the same an authority that is obeyed.

45. 3. *Gandhiji's Khadi.*—Under the impulsion of Gandhiji's voice—the call to political as some say but humanitarian service as Gandhiji has it—Khadi has given a food value to idle hands, wasted hours, and hungry mouths, millions in number.

45 4. *Room for capitalist.*—What these do, the capitalist may do under proper conditions, although he may put out his money, out of no philanthropic motive.

46. 1. *Discordant elements holding together.*—For, the India of today is Nature's cauldron in which are gathered all the ingredients of a great civilization. The Hindu conserves the virtues of Ancient Civilization; the Muslim cherishes the glories of the Middle Ages; and the Britisher represents the power of the Modern Period. Varieties of races, religions, and cultures, caste and colour, as divergent as may be, are pent up within the Indian Frontiers. They live side by side, the lion by the lamb, in amity and peace. Such was the aspiration of the ancient sages (Siddhashrama) and such is the proud achievement of Pax Brittanica.

46. 2. *The Law of the Jungle.*—Discordant elements, the hyænas of towns, are, however, ever ready to break the King's Peace and set up the Law of the Jungle; but the common sense of all keeps a constant vigil. There is nothing worth having, not even Peace, unless it is to be fought for.

46. 3. *India in Transition.*—India is in Transition, passing from the old to the new; from the mediæval to the modern; from one culture to another. It is inevitable that in this period the divergences should be multitudinous and not harmoniously graded. The grotesque and the picturesque may be cheek by jowl; the incongruent, obtrusive; the contrasts and confusions, striking.

46. 4. *Old ties loosened.*—In this transitory period, the old ties have been dissolving (except for persistence of family life) and new ties have not yet been formed. Modern Western Life is conceived of as an emphasis on Individualism and Hedonism, each unto himself and each to put his own ease and comfort before other things, and drink life to the lees.

46. 5. *True Greatness of the West.*—Little understood is the fact—because it is not so apparent—that Western Civilization has its spiritual side, has its roots in Truth of Knowledge and Belief and in the principles of Self-Help and Self-Sacrifice, even where the Dedication may be merely to Nationalism.

46. 6. *Deus ex machina for everything.*—Not seeing the West in its true light, Modern India may tend to look to *Deus ex machina,* always, for all things under the Sun. Accordingly, in the release from old bonds, the calls of Patriotism or Nationalism, of Politics or Religion, have a response—but in varying degrees, under the new conditions. Politics makes the largest appeal to the English-educated Indian.

46. 7. *Sects.*—Of course, there are, and will be, in India, as in any other country, persons exploiting the mob mind. Great Leaders have been springing up, obtaining large following; but the caste-forming spirit often makes each a sect.

46. 8. *Schisms.*—The fissiparous tendencies of Indian Life have been much noted, but even these seethings, breaking out on the surface as communal, provincial and linguistic jealousies and racial and religious antagonisms—those old familiar things—are but symptoms of *new* ferments at work making a *better* India.

PART III—CONCLUSION.

India has been awakening into Modernity through the Impact of Europe, the Connexion with Britain, and the Linkage with the World. The new forces permeate Cities and Towns; and, thanks to the Car and the Radio, they are penetrating Villages, where it is, that 80% of her teeming millions dwell. Of the leading features

of Static India, Isolation is gone (save only in World Politics; and there it is complete); Self-Sufficiency is rudely shaken; Caste is responsively adapting itself; Cultural Lag alone has been slow to change, trailing, as it does, the Sense as well as the Memories of the Past. Even here, there is a stir of new life—this very Science Congress is a sign of it.

The leading agencies of the Metamorphosing now on, are both Foreign and Indian—Institutions, Societies, even Trading Companies; communities, individuals, and men of all occupations. The Human Elements are active while the Physical are fairly constant. The Future will be the Integration of all the Changes going on both big and small.

The old Static Geography sees only the Pressure upon Land, the Appalling Poverty, etc., of an Improgressive India. The new Dynamic Geography can see the forces at work, and disengage the true causes from the false. It finds that the causes are not inherent but removable; that man in India has fallen behind and is catching up: only, he has not, as yet, risen to the height of his opportunities.

At a given moment, geographical conditions are in equilibrium, but the equilibrium is of the Unstable kind. The Spirit of Man and its acquisition of strength through Creative Knowledge react upon his Place and his Work, bringing about constant change.

Here, in India, all the Cultures of the World meet, in all their variety and range; and a great composite civilization is growing under the influence of them all. Therein will lie the diversity, richness, comprehensiveness and greatness of the Indian Civilization that is to be.

England is the Synthesis of Northern Europe, the United States is the Synthesis of All Europe. India is to be the Synthesis of the Whole World.

Dynamic Problems of Geographical Reconnaissance in India

By

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During some years of absence from India, experience has shown me how much geographical research can be done from the library chair or rather the mapping table. Of the official publications the topographical and atlas maps of the Survey of India come first for us These make it possible to perceive much of the character of the physical and natural environment. One can thus note and generalise the true location of the statistical data of agriculture, population density and the like, and so proceed to rebuild the statistical fragments into a scheme which increasingly approaches the geographical synthesis, the geographical truth we seek. And for those who would grasp what is always known, the dry facts of the official surverys and data are constantly illuminated by written reports, memoirs and studies of high standard. But for those who would go further, and who seek to add their quota to the understanding of India's geography it is the permanent and relatively unchanging features which can be re-mapped, re-classified and re-interpreted. I refer to facts of relief for instance or to the broader distributions of vegetation. The same is true for changing facts recorded at a given date, such as the position of a shifting river, the boundary of cultivation and habitation at the time of survey, or the statistics of population density at a particular census date. It is when we come to what I shall call "the dynamic" aspects—to facts of change and their character, and to processes in course of actual, observable evolution—that field observation becomes increasingly necessary. And if we seek to understand in order to re-plan, if our "survey is for service," then it is all the more needful constantly to renew in the field direct contact with reality in life and change.

A year ago, Prof. A. G. Ogilvie outlined to this Congress a number of the problems, both static and dynamic, which lie before us and he indicated methods with which to deal with these.[1] To

1. A. G. Ogilvie, University of Edinburgh, *The Technique of Regional* Geography, with Special Reference to India. (I.S.C.A., Calcutta, 1938. Repr. in J. of the Madras Geogr. Assn. 1938. These notes having been written while on tour, there has been no opportunity of verifying or extending the references given.

this paper, to which I shall have occasion to refer again, I had the privilege of making certain contributions. Hence the following notes, made in the course of all too rapid tours in different regions of India, may be considered simply as a sequel to and commentary upon the succinct review of problems and methods outlined by Prof. Ogilvie. Along with Prof. Ogilvie's paper I wish to refer to the work on India of Jules Sion, in the *Géographie Universelle*.[2] For Prof. Sion's work on "the monsoon lands of Asia", is to be thought of not simply as an excellent explanatory account of India and the Far East, but—what is relevant to my purpose here—as a study full of questions to guide and to awaken the observer here in India. For while Sion was prevented from visiting India, he is himself an admirable field observer as both his earlier and later works have shown.[3] Hence his writing upon India is full of suggestive enquiries for the field observer. These he has also set out in a note upon Indian population[4] and in a short article in English upon method in Geography, with applications to India.[5] The forthcoming work on India by Prof. Norbert Krebs of Berlin is one to which we look forward for an illustration of method from still another school.

Before we come to what, in this paper, I have called the "dynamic" aspects, it must be remembered how many of the "static" aspects remain to be analysed and classified. Relief is fundamental, and for most of India, we still await an explanatory description of the landforms of mountain and plateau. The character of the plains, of their deposition and partial re-dissection, awaits description and re-mapping—a matter of subtle relief but one vastly important for the understanding of the regional habitat from the Punjab to Bengal, and around the coasts of the peninsula. Again we require a map for the major regions, for the provinces of India distinguishing the areas mainly cleared for cultivation from the rest, forest or waste. The Survey of India commenced a "Ten-mile" Atlas[6] but proceeded no further than a preliminary edition of Vol. I, Bengal and Assam. The scheme has gone no further, because of financial stringency and the smallness of a public educat-

2. J. Sion. *Asie des Moussons, Vol. II, Geographie universelle*, Paris, 1927.

3. J. Sion. *Les Paysans de la Normandie Orientale*, Paris (c. 1905); (in collaboration) *La Mediterrannce..........Geographie Universelle*, Paris, c. 1935 *et seq.*

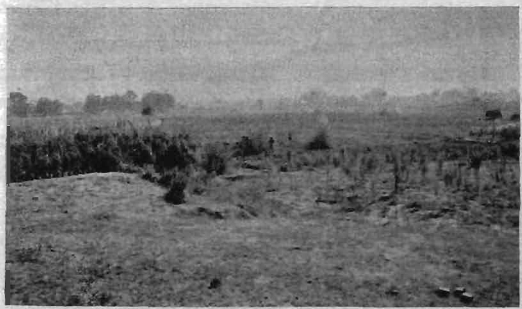
4. J. Sion. *La Population de L'Inde d'apres les derniers recensements, Annales de Geographie*, 1926.

5. *Calcutta Review*, 1926-27.

6. The "Ten Mile" Atlas, Vol. I, Assam and Eastern Bengal, Published by order of Brigadier E. A. Tandy, R.E., Calcutta, 1928. (Out of print).

ed to observe a countryside and to use maps. The need for such a survey is suggested by Mr. Yeats, the writer of the Census Report of Madras, 1931. I have myself sketched the boundaries of cleared lands and of waste with forests for the Chota Nagpur Plateau (Bihar) and for Orissa.[7]

If one tours in India, however, one realises that in detail this line dividing cultivation from waste is not static but dynamic, a moving battle line. For the cultivator is trying to extend his cultivated land at the expense of waste, in order to grow his crops, feed his crops, feed his family, and organise his life. Or the stage of extension may have ceased and he may be struggling not to extend but to maintain the clearance made by his forefathers, while owing to erosion of de-forested "Jungle," gravel and sand may be scattered over his fields (as along the foot of the Himalayas in the Punjab) actually pushing back the line of cultivable land. It may be added that the nature of forest, and its distinction from damaged or useless waste, is important. The



Meeting line of Cultivation and Waste.

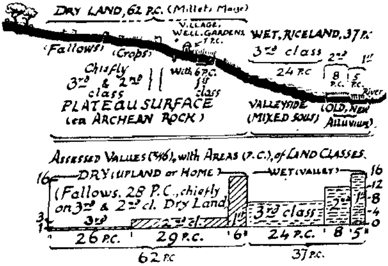
"ideal" forest types of India have been succintly described and mapped........in a single well-illustrated volume;[8] but in addi-

7. Arthur Geddes. India: (I) The Chota Nagpur Plateau and its Bordering Plains. *Congres International de Geographie*, Amsterdam 1938. Tome II, Sect. IIIc. *Geographie Coloniale: Question: Population et utilisation du sol.* Since this was done I have noted that the Road Map of Bihar and Orissa, on ten miles to inch scale, includes contours and forest (Patna and Bihar).

8. H. G. Campion, *A Preliminary Survey of the Forest Types of India* (Ind. Forest Records, N. S. Vol. I, No. 1, Delhi, 1939).

tion to this, the Forest Department have noted "forests" for certain areas or provinces on large scale maps, with index maps which are of real use to the geographer. It should be possible readily to combine these and other data in an inital comparative survey of forest and of cultivation. Indeed a great deal of useful preliminary correlation can be achieved simply by placing two sets of data found side by side in the field. Such data are collected separately merely for the convenience of administration; but when they are so—as in the case of Agricultural or of "Forest" maps and data—it is essential to reassemble them in order to apprehend regional unities.

Closely connected both with relief and with the forest cover, at its removal, is the question of soil erosion. The peasants' cart-rut, and still more the road engineer's drain, may set agoing, in the torrential downpours of the monsoon, little waterfalls which, eating back, multiply themselves over field and jungle. The scour of the monsoon storms, so noticeable as one goes afield, is perhaps most striking of all from the air. The pattern of river and



Hazaribagh District: Chota Nagpur Plateau— Ideal cross-section of Valley.

tributary is frequently spoken of as "dendritic"; but the effects of headward erosion I have seen over miles of ruined countryside have made me think of giant claws, scouring away sown crops of pasture cover, soil and sub-soil. In this way slope deserves description not simply as a static fact. When related to rainfall, the degree of slope is of course indicative of latent energy which sets the rainwater in motion, scouring and denuding, to deposit gravel, sand or silt when the slope slackens. The indications of gullying given in the topographical maps are helpful. And when these are generalised on reduced scale mapped for an area such as the United Provinces, together with the relief—the terraces, sandy ridges and clayey hollows—of this portion of the Ganges plain,

they help to indicate the problems and difficulties of the cultivator.[9]

The importance of the rythms of the seasons, and the annual rythm of cultivation and kindred occupations was stressed last year by Prof. Ogilvie.[10] The Indian examples he selected were, it will be remembered, of three types, in diagram form. The first shows vertically the area of crops for a region together with the normal seasonal duration for each crop (shown horizontally).[11] The latter was of course drawn in relation to the monthly scale of temperature and rainfall. Here I would only add that I accept the plea made to me by Dr. V. K. Badami, of Mysore, that for temperature the means of maxima and minima, rather than the ordinary monthly mean be used, wherever temperature is the critical factor. The same should no doubt apply for rainfall, but without overloading the diagram, of which the function is to summarise. The usefulness of such a diagram lies in showing the re-

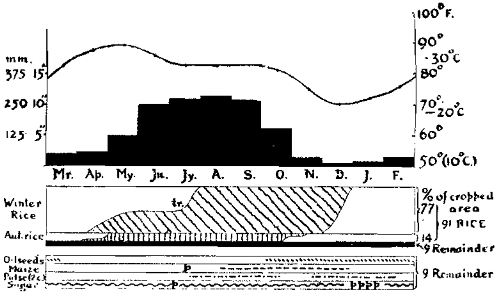


Diagram of the Annual Rhythm of Cultivation in Orissa (Balasore District) in relation to mean temperature and rainfall.
P —one ploughing ; tr.—transplanting.

lative duration of crop and fallow according to area. It indicates too, if it does no more, the season of labour or of idleness. It is because of the widespread duration of a slack season in India that so much has been made of the *charka* and the need of finding employment for the villager. Surely stress should be laid not on getting the cultivator to spin which, after all, is the characteristic

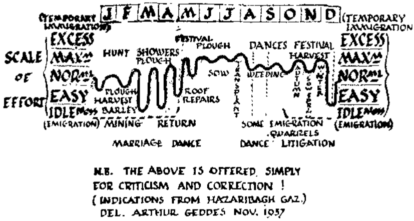
9. These features were generalised at Edinburgh University in collaboration with a student on a M. S. map of U.P. on 1|M. scale.

10. *op. cit.*

11. Amplified in two papers: A. Geddes, India (I) and (II) *op. cit.*

job of the "spinster" and the widow, but on helping him to carry on his proper work of cultivation throughout the year and similarly to employ his bullocks, which are an extension of his physical strength. There are of course two chief ways of tackling this agricultural problem. An ancient way, but one not yet fully mastered, is that of irrigation. Too often irrigation has proved successful in the first years and has been followed by damage thereafter because of over-irrigation and water-logging.[12] The other and complementary method is that of dry-farming, now being seriously studied.

This type of diagram, though it combines a crop area and crop season does not show the actual amount of human work performed with any precision. Hence the need for a second type of graph which should follow on from it and be its complement. This



Seasonal Rhythm and Effort—Northern Chota Nagpur Plateau.

was originally devised by Deffontaines,[13] and his term,—*horizon de travail*,—may be translated as seasonal employment throughout the year. The term ergograph should certainly include this type of diagram. For its preparation, even if one is oneself prevented from making a long stay in the country, Settlement Reports give considerable data. And comparison of the monthly and annual labour bill per acre on a Government District Demonstration Farm collated with the customary practice on a ryot's holding (often detailed in District Manuals and Reports) should give fair accuracy. The Government Farm could give working hours per day, but Deffontaine's graded scale of effort is one a peasant could understand. Between the extremes of more work at harvest time

12. See for example the Irrigation Reports and Technical Papers for the Punjab (Bernard Wilsdon, Mackenzie Taylor and Others), or for Bombay (*C. C. Inglis*).

13. Deffontaines on the peasants of the Moyenne Garronne (Paris, recent),

than the peasants of a region can manage without importing help, and (conversely) of so little to do that emigration is sought, are three grades: maximum, moderate, easy. A third type of diagram of annual rythm can show seasonal migration.

There are many other points on which I should like to touch. One very interesting study is the homestead. The great French geographer Demangeon has said that the homestead, housing the cultivator's family, animals and crops and built for their need is almost "a living thing." The plan shows the peculiar relationship of the crops to the animals and of the family and household to their activities. In the interesting movement for village uplift, which has struck me greatly on my return to India, housing is important. And with increasing safety of life and property many changes are possible. Not merely are light and air and sanitation important, but daily work and (I should like to add) recurrent leisure. I think geography may endeavour not merely to consider the plan of the homestead as one finds it but to see, by comparison with varied types, how far the homestead plan can be bettered in view of existing, and potential, regional activities. This brings me on to the interesting question of the house itself, the family home. Now I think there is a certain lack of objectivity in many allusions to the joint family. How often is one told in India than in Europe there is separation of families, each individual European family living by itself, whereas the joint family system, is said to be the rule in India. It is added that modern life is breaking up the peasant joint family and causing a new state of things, the undue separation of families. In the first place my observations suggest that the joint family is not really characteristic of the ordinary peasant cultivators of India. It is certainly usual to find two grandparents, young parents and children living together. Quite often two brothers, certainly if one of them is still unmarried, may work the holding which was their father's. But the joint family on this restricted scale is a human institution not unknown in Europe and characteristic of peasants everywhere. It may not continue beyond one generation without renewed fission because it means giving up responsibility too long. But in most countries it is felt that the father of the family should have the farm in his hands, with the grandfather's advice to guide him and the direction of the unmarried sons. In India this direction is continued after marriage. One should realise that the joint family, on the really extensive scale known to the land-owning "middle classes" as even now in Bengal, is not usual among cultivators. The phenomenon is in the main restricted to a single class, to a single style of property. What

is usual among cultivators is (1) a restricted amount of joint ownership over two (or three) generations (as just described) a condition still such as we find normally in Europe; and (2) a tendency for a couple of brothers to carry on together, after their father's death, in order not to break up the holding, again a feature also characteristic enough of old-fashioned peasant Europe wherever emigration to the towns has not predominated. Now the advantages to two (or more) brothers of holding together have always been offset by the advantages of independence. Modern life with its commercial, competitive marketing, is probably tending to greater individualism than in the past, but some desire for independence is no new thing. So let us get our facts clear and avoid sentimental generalisations. The Census of course is helpful. It gives the average number of the "commensal" family, of which the members share their meals, and this corresponds very closely to the European family of 4.5 to 5 members. But with this should be compared the numbers of those holding land together, a matter on which we shall expect to find data in the Settlement Reports. And as in each Report conditions are carefully compared with those at the preceding Settlement, they form an interesting record of contemporary change.

From consideration of the single house, we come to that of the village unit. Again the village plan must be related to village economy, present and also past, if known. The working ways of the village and the extent of co-operation or of hiring of labour are vitally interesting. Now the face of Europe has very greatly changed since the Agricutural Revolution which frequently brought about the break-up of a village wherever village homesteads were lightly built. They tended when they were re-built to be re-distributed on separate holdings as in Denmark.[14] And as every one here knows who has been to Britain, isolated farms are common and in Scotland, the village is a rarity and a purely agricultural village is almost unknown: villages there are miniature towns with artisans and shopkeepers. Now what is at present happening to your villages? Will re-building of homesteads be done *in situ* or will there be an increase of dissemination? In the Central Bengal Delta, where population has actually diminished since 1871, (and before) the *math* or open rice land shows few homesteads; but in the teeming Eastern Delta the *math* is doted with new homesteads. The commercialism of the nineteenth century overstressed the importance of Darwin's thesis that competition was a dominant

14. Question: l'Habitat rural (Congrés International de Geographie, 1932 and 1935).

force in evolution. Complementary to it, indeed contrary to it, is 'mutual aid.' This conception of Kropotkin, who was not simply an idealist, but a keen observer of societies, plant, animal and human, is important today in scientific philosophy and in social progress. It plays its part in constructive efforts such as communal farming, and in the struggles for freedom so savagely retarded, so bitterly fought in Europe or in China. How might further co-operation affect our village and its plan ? Are we only to expect an increasing break-up of socialised unit, or can we look forward to increasing re-socialisation of the village unit, with the Panchayet reinforced and co-operative organisation in full play. If so we are justified in considering the problem of the village, the village roads, fields and so on, in view of increasingly socialised units. For the danger of the most honest politician is that in preparing his programme he will unconsciously project his boyhood memories of his own village and region upon his whole province, or upon all India. Here again objective survey is required ; and we geographers should be ready with our contribution, as these ideas are worked out, region by region.

Prof. Ogilvie has stressed the importance of population mapping,[15] and I have endeavoured to apply this in plain and in plateau country.[16] Here I need only point out that while density can be satisfactorily plotted from published census figures, given topographical maps, the accurate localisation of actual change is far more difficult without much more detailed statistics than are published. If statistics of population of villages for 1931 could be kept after 1941 instead of being destroyed, and embodied in well generalised maps of change, I believe that very significant conclusions could be obtained. In view of the burning interest in peninsular India in the question of "linguistic provinces", it may be well to mention certain related problems. The relationship of language, of religion, and of other criteria of culture, not only to each other but to economic distribution can undoubtedly be clarified by conscientious use of geographical method. In Southern India, at this time, when few regard the internal political boundaries of India as either economic, just or final, I was struck by the rarity of any discussion of possible economic provinces. The concept of the region, and even the word, is rarely met with. I have little doubt that, as the mapping of important distributions proceeds, without slavish adhesion to existing political boundaries, geography can do much to guide the reformation of her internal political frontiers.

15. A. G. Ogilvie, *op. cit.*

16. A. Geddes, The Population of Bengal, a study in method, Geogr. Journal, March 1937 ; and India (I) and (II), op. cit. (Congrés International Geogr., 1938).

Last of all we come to the city, of all geographical phenomena that in which the human factors are the most concentrated and the most dynamic. Since first I was engaged in town-planning work in India, the study of cities has been immensely facilitated by air photography. An air view of Calcutta brings out at a glance the areas of pukka buildings or of mud built quarters (*bastis*). And the improvement—or the devastation wrought by town-planning which has preceded geographical and socio-economic survey, instead of following upon it, can also be deciphered. This immensely simplifies the problem of preliminary urban reconnaissance. For on re-emerging from the labyrinth of streets and lanes, of homes, workshops and factories and fields, the elements of order can be located and collated. In this way the possibilities of economic and truly socialised planning can be ascertained. The studies of Indian cities found in town-planning reports are ready for the geographical compiler. I hope that if support is forthcoming a selection may be published from the pioneer Surveys and Reports on town-planning by Patrick Geddes.[17] But no existing report is complete, and still less final. Hence the geographical method of study not only of the existing city and its site but also its situation in relation to its region and to neighbouring cities is required for better planning.

17. Cities of the Madras Presidency (Madras 1916); Lucknow (C. 1918; Burra Bazar, Calcutta (1919); Indore (2 vol. 1919); Patiala (1921), and others Cf. H. V. Lanchester, Madras etc. The little manual by Linton Bogle on own planning, is an excellent guide to principles for India (Milford, India).

Impressions of Lahore Science Congress, 1939

BY

M. SUBRAMANIAM

On January 2, 1939, the Science Week of the Indian Science Congress Association was inaugurated at the University Buildings of Lahore by H. E. Sir Henry Craik, the Governor of the Punjab. Dr. J. C. Ghosh of Dacca, the President of the year, delivered the General Address, reviewing Science Progress in India. From the following day, the eleven sectional presidents gave their addresses to their several sections.

Geography has been made into a separate section permanently from this year; and Mr. N. Subrahmanyam, M.A., L.T., F.R.G.S., of Madras, this year's president, delivered his address to a throng of delegates from all sections and from various Provinces. The subject chosen was, "The Geographical Personality of India." The address met with warm approbation all round, for matter, form, and style. 'It is a comprehensive survey of India,' said some, 'It makes a new synthetic approach'; 'it is eloquent, brimming all over with sympathy,' said some high authorities. 'I never thought Geography can be so full of life and interest,' said many a delegate, upon hearing it read.

This new section of Geography was able to attract as many as twenty papers on various topics. Dr. Chatterjee of Calcutta led off with his Lecture on Ranchi, giving it, he said, in the true French manner as a series of slides with explanations in between. His next paper on Puri was similarly done. Mr. A. C. Bannerjee, also of Calcutta, read a paper on 'some of the markets of Calcutta.'

Mr. B. M. Tirunaranan of Madras presented two papers; one was on certain methods of anticipating Tank Breaches; the other, on the Boundaries of Tamil Nadu. He made helpful contributions to the discussions, accompanying them often with drawings on the blackboard drawn with remarkable ease and accuracy. He has a working belief in the maxim, '*no* Maps, *no* Geography.' It may be stated, by the way, that from his study of Lahore Map, he made himself, on the very first day, as familiar with the streets and lanes and buildings as a long-time resident. And he has done so for other towns he visited on his way to Lahore up and down.

The summaries of several papers of absentee-members were read; and others were taken as read. These are a few titles of such papers:—The Sources of the Brahmaputra; Sugar-cane cultivation

in India ; The growth of a modern city (Coimbatore); The Fisheries of Cochin; Cole Cultivation in Cochin; Results of irrigational changes in Tanjore; Potential Spas of Sind; Greater Karachi; Tanning in South India; the Cheyyar Basin; etc.

Besides the papers of the Section, there were joint discussions with other Sections.

Dr. Arthur Geddes of Edinburgh, who had been on a Geographical Tour in India stayed on expressly to attend the Geography Section at Lahore before sailing home. He read his suggestive paper on "Some Problems of Geographical Reconnaissance in India", which is valuable equally for the methods indicated and for the new angles of approach in geographical studies. In his quiet but illuminating way, he made valuable contributions to the several discussions. With ever-ready pencil, note-book and camera, he sets an example to field-geographers in India, taking notes and sketches, observing keenly, and vivifying and verifying facts, wherever he can.

Prof. Pithawalla of Karachi made a plea for a Regional Division of India, so as to make such division the basis of scientific records. Admittedly, the present Political Divisions of India are not helpful from a scientific stand-point, being mere divisions of administrative convenience or bare results of historical accidents. A division by natural regions is a want generally felt but there is no consensus as to the criteria or their practical application.

The particular map drawn by Prof. Pithawalla turns largely on geological data; but, observed Mr. Tirunaranan, it did not adequately provide for climatic differences: the same relief sets up two different regimes of life, one on the front and the other on the lee side. Prof. Agharkar of Calcutta presented the Botanist's objection. The Botanist is not impressed by geological limits, he said, and would have his divisions follow ecology; every science should make such divisions as suit it best; and the time for finding elements common to all is not yet.

The Discussion on the Dynamic Role of the Modern Geographer was opened by Mr. N. Subrahmanyam in a lucid and convincing speech summing up the arguments from all points of view. Followed by Mr. Bannerjee, Dr. Chatterjee reverted to the teaching side; and incidentally threw it out that he intended making a soil survey of Bengal, by sampling, with his band of 150 scholars, in the Long Vacation. Dr. Geddes pointed out how inadequate it must be and he and others thought that Government alone could do it well, and suggested better utilisation of Government records and machinery.

The next discussion was also opened by the President and it was on The Agricultural Cycle in relation to the Rhythm of Life in India. Dr. Ramakrishna Ayyar of Coimbatore, the Entomologist, dwelt on the necessity of co-ordinating efforts and putting the valuable results obtained into a *calendar provided with maps and charts*. He pointed out also the attendant difficulties. Mr. Ramdas of Poona gave the Meteorologist's view. For this very purpose, he said, phenological studies of 3,000 plants have been taken up in England; not one plant has been so observed in India; it will be a long, long time before any success can be attained. All were agreed, however, that each department should make its own start, even now, making fullest use of Geographical Methods of Distribution, Correlation and Expression.

Mr. Mackenzie Taylor of The Irrigation Research Department opened the discussion on Erosion, touching on all its Indian aspects. The *pièce de resistance* was the contribution by Mr. Gorrie, who, with well-planned slides, convinced all present of the havoc wrought in the Punjab by the unrestricted grazing by goat (to which should be added the camel). Such places were contrasted with the careful husbandry in Hissar; the Punjab sides with the U. P. sides of the same mountains. His remarks explain the denuded landscape that greets the traveller in the Punjab; the denudations are so extensive that he, too, that runs by rail or bus, cannot help reading them.

It was acknowledged on all hands that in the discharge of his several duties as President, Mr. N. Subrahmanyam was admirably tactful and business-like.

The last, but by no means the least of his work, lay in his infecting with his own enthusiasm the Geographers of Lahore so as to bring them together into a common association, reconciling certain conflicts of view that showed themselves. There has been a Punjab Geographical Association under the guidance of Rai Bahadur Sohan Lal who has done yeoman's service for Geography in schools. As a result of the appeal, it has since opened a Research Section. There are keen Geographers in the Punjab. To mention but a few names, there are Messrs. Dean of the Forman Christian Collge and Syed Gauhar Ali of Gujrat ; the Misses C. L. H. Geary of Women's College and Grace W. Mason of Kinnaird College. The University has Degree Courses already. One may therefore confidently hope that Punjab will stride into its rightful place in Geographical Research before long.

Mr. Dean as Local Secretary made the arrangements, excellent; Prof. Bhatnagar was all attention; the Local Secretary, Diwan Anand was very obliging. The General Secretary, Mr. J. N.

Mukherji, has brought scientific method to bear on the working of the Science Week and has raised it to a Fine Art. The working, accordingly, went off efficiently. smoothly and grandly.

The foregoing description is a brief account of the transactions at one section only, the Geography section, the youngest section and a small segment of the whole. At the Physics section, discussion on one paper alone went on from day to day; the number of papers in Chemistry Section fairly beat the time and would last beyond Sunday but for closure.

There were side-dishes also: every evening there was a general lecture and one morning, Sir Shah Sulaiman, the Federal Judge threw on the screen his formulae combining Newton and Einstein, the verification of which he expects in the Solar Eclipse of 1940.

At the Science Week, the output of intellectual work is great; and much of it is available, too, later on, in cold print. But greater than that by far is the coming together into close contact of kindred spirits from far and near. To meet, discuss and 'change views is a rich and freshening experience inexpressible in words but none the less invaluable. Of such, all have had their fill.

And then, the Social opportunities, how great they are! The Science Congress was provided with sumptuous entertainments. H. E. The Governor was At Home at Government House in the open lawn amid pleasant greenery. The Reception Committee gave an open air Tea in the cool January evening. It gave also a Variety Entertainment of which Miss Zutshi on the *sithar* is an outstanding memory. The Farewell Dinner, setting before guests a truly Punjabi hospitality, was given in the University Hall where His Excellency gave the toast of the Science Congress. The Madras Community at Lahore entertained Madras visitors at Tea. Such rounds of social meeting brought folks closer together than ever.

And then, the Excursions! The first was in the City itself. One cannot behold without emotion the ruins of former Moghul splendour visible in Shalimar gardens, the Shadhdara Mausoleums of Jehangir and Nur Jehan, the Badshahi Mosque and the Fort; nor the former Sikh Power writ large in the small Ranjit Singh's urns and the Baradari, where he held his court. The Lahore Museum exhibits the History of Punjab displaying the vestiges and Art of Hindus, Buddhists, Greeks, Moslems, Sikhs etc., from early times. It is an impressive sight to see the little finger of the Punjab Policeman, expressive of British authority, keeping order at the Mall or the Railway Station among the unruly and burly crowds.

To the Geographer, the special points of interest are the luscious grass, the hardy tonga-horse, the hardier men; the rich bazaars and the profusion of fruits and nuts and vegetables which are very cheap and widely consumed, the Park-like environs; and the Old Ravi and the New Ravi breaking through old-time pleasure-gardens of the Moghul.

The excursion to Amritsar traversed the Trunk Road which s flanked every now and then by villages looking like little fortresses or their ruins. The Khalsa College gave Tea in a delightful shamiana on the college grounds. Amritsar is one of the biggest of Trades-capitals of North India as well as the Sikhs' Holy Place. It is most densely peopled, narrow gullies being the rule, wo-car roads the exception. The Jallianwala Bagh is maintained as a solemn garden. The Golden Temple with pavements of marble and cupolas glittering with gold; the Tank with marble paths and marble steps; the Temples round about in memory of former Gurus are living testimony to Sikh fervour and Sikh inspirations. Other Gurudwaras, seen at Arjun Singh Saheb, Shahidganj or Panja Saheb near Taxila, leave upon one the same impression. A simple, solemn air pervades those places of worship, where Bhajan to the Grandh Saheb is maintained perpetually amid throngs of religious men and women.

The excursion to Taxila, which is eight hours by rail, was splendidly arranged. A special train took the delegates by night and the whole day was spent amid the hills and the museum, and he several ruins. The weathered Buddhist stupas, the exposed ite of the Greek Town with a Greek temple on the opposite hill, he wide circuit of the ancient city, and the collections n the Museum thereof specimens of ancient art testifying o former excellence and glory are ineffaceable impressions. At he beginning of the Christian era, it flourished as a University Town and Religious Centre. Its hills and its situation on the Road to India from the West, only about a hundred miles from he Khyber Pass account both for its rise and for its fall. It had life of 800 years at least when it fell to the fury of invading osts about Vth century A.D. and was buried in its own debris. The uin, once begun, weathering and the dust of centuries completed . The River Hari is in active erosion; and there is much to nterest the geographer, as could be seen in Dr. Geddes' being usy taking notes of the entirely different types of men and place, ettlements and country.

Taxila is a lesson in Historical Geography; Lahore and Amritsar, in Modern; but Lyllapur bears the seeds of Future Geography of the Punjab.

The Agricultural College at Lyllapur is not surpassed by any other in India. Experiments are carried on in all matters of interest to the Ryot; and the Ryot, *with his simple but strong faith and strong will*, has taken kindly to the knowledge the college provides him. Such co-operation is found nowhere else in India. Ryots, by thousands, BUY BACTERIA to infect their lucernes with, for feeding their cattle. The cultivation of rapeseed and of rye has been introduced by the College. Sugar-canes, bred at Coimbatore, are tried in the college first and then the Ryots take them: some successful ones are only a six-months' crop. The Fruits Experimental Garden is the best in India, what with vines, dates, oranges, plums, palash, etc. Experiments are in progress in fishery, in implements, in cattle food and breed, dairying and manures; in cotton and wheat, two of the principal sources of Punjab Ryots' wealth. The tried and tested successes pass on to the Ryot readily.

Near-by are Oil-mills with Hydrogenation plants; and there is a cloth-mill to which move long strings of asses and camels laden with cotton.

The roads raising clouds and whirlwinds of dust under motor-wheels; the ashen grey soil; the straight canals spreading fertility wherever its waters can reach; the plains beyond, denuded by goat and camel which leave not a shrub behind; the ramparted villages verdant with growing wheat and oil-seeds—all provide the geographer with ample food for thought.

Back to Lahore in the nipping cold, and then to the train to Madras, the ticket-dates being up. Geography and History together force themselves upon one across the Railway carriage windows. To mention one or two: the bad lands of the Chambal are among the best of their kind in India, and among the most extensive. Geography makes it plain why the conquerors found it so easy to spread along the Indo-Gangetic plain from West to East (as the Moguls did) or from East to West (as the British did)—but not from North to South or *vice versa*. It explains why the loyalty of Dinkar Rao and Sir Salar Jung was invaluable in the Sepoy Mutiny. Even through the windows of an Express Train one can read the importance of Gwalior, Jhansi or Bhopal.

Altogether, it was a great experience to have attended the Science Week at Lahore.

"Some Impressions of the Punjab"

The thirteenth annual meeting of the Association was held at the Meston Training College on 17-2-1939. The Annual Report was passed, and Office-bearers were elected: Miss E. D. Birdseye is to be the President of the year.

An ordinary meeting was then held with Sri M. Subramania Ayyar in the chair, when Sri N. Subrahmanyam, M.A., L.T., F.R.G.S. gave a lecture on "*Some Impressions of the Punjab.*"

The following is a short summary of his lecture:—

The climate is very hot in summer and very cold in winter. The soil of the Punjab begins from west of the Jumna and north of the Chambal: it is a grey alluvial powdery puff; when water is brought to it, as is done through long miles of canals or by baling from wells, it yields rich harvests of wheat, pulses, oil seeds, grass and vegetables of both seasons; it supports fine breeds of cattle like the Hissar and the Montgomery, besides hardy ponies, donkeys and camels. Under the bracing climate and the richest dietary in India, which includes milk fruits and nuts, and under the hard work entailed by the soil and the situation at the frontiers of India, the Punjabi has developed into a strong man, amenable to discipline; he is a man of deeds rather than words. Half the Indian army is recruited from the Punjab. Forts, palaces, gardens (like Shalimar), mosques and mausoleums testify to past Moslem grandeur; the Golden Temple and Gurudwaras, to recent Sikh power; and Extensions and Cantonments to present British modernity. The race of builders is not dead altogether, as Dayalbagh memorial shows.

There is great promise for the future. Already the industrial side is developing on top of agriculture; flour mills, oil mills, cotton and woollen mills, workshops, hydrogenation plants, chemical works etc., have been springing up, while cottage industries are quite alive as at Ludhiana and Guzrat in face of competition. Science finds responsive application; e.g., the chemical laboratory at Lahore has found new uses for rape-seed as motor-oil mixer and has put some lakhs into the pockets of the peasants; Bacteria to infect lucerne is sold at Lyllapur and peasants by thousands buy them. Illiterate as they are, they are the most progressive in India, being ready to translate beliefs into acts.

The Modern State of Iraq

By

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Much has been written of the "Near East" as an area o transit between East and West throughout the centuries. Thi importance is due to its geographical position ; and, of the countries making up this area none has more significance from thi point of view than the modern state of Iraq. The importance o this state is accentuated by the mineral wealth contained withi its borders in the form of oil, perhaps the most vital of th mineral resources of the world to-day. These two factors, combined, have caused Iraq to become an area of intense political interes to the major powers of the twentieth century world. And as a artificially created state of Post-War origin, Iraq also presents u with two further points for consideration ; her agricultural dependence upon irrigation, and the welding into a new nation of conflicting peoples with their several interests and problems.

Geologically Iraq is a sunkland, situated between the ancien Archaean plateau of Arabia, and the fold mountains of Persia The latter ranges are of many different ages, but mainly Cainozoic, and the Mesopotamian trough is therefore comparable wit the Indo-Gangetic plain in age, origin and structure. The Persia Gulf is of very recent origin and is bounded by major faults givin abrupt mountain-scarps. The border of the Iranian ranges is however, marked by more gentle anticlines occupying part of thi sunken territory. The Pusht-i-Kuh which form the Iraq-Persia boundary in Lower Iraq have the arc-like trend so characteristi of mountain-folding of Tertiary times, and provide yet anothe similarity between this area and comparable areas of the Tethy zone, as the Himalayan region. In Upper Iraq, north of th Diyala river, the mountains are less lofty, and the foothill zon is more marked, while the arc-like trend is less developed. Henc the trend-lines of the mountains of Northern Iraq, i.e., Kurdistan are often unsystematic and difficult to trace, unlike the clear-cu N.W. to S.E. trend of the Zagros wall, and the (roughly) E. t W. trend of the main Armenian chains. South of these latte mountains is a belt of treeless, stony country, 40 to 100 mile broad, extending as far south as Hit, or the old coastline befor the formation of the alluvial plain. The extremely flat alluvia plain slopes away from both the rivers, and thus makes possibl the extensive perennial irrigation on which the ancient civiliza

tions of Sumer and Akkad were based. The alluvium is rich and fertile, but thins out to the west, as the desert streams contribute but little sediment to the central plain, and the actual plateau is of the arid type.

The Tertiary beds underlying the Mesopotamian alluvium have been folded up into anticlinal ridges. These rise above the alluvial plain as striking and isolated ranges of hills running across the plainland of Iraq, and merging in places into the Eastern mountain wall. Near the Euphrates, about Lat. 36°N., are the Singar mountains, the east end of which is in Iraq; they are characterised by a peculiar wall-like formation, regular and straight. Comparable with them are the Jebel Hamrin, crossing the line of the Tigris, starting from approximately the same latitude, but trending S. E., parallel to the Zagros. Less pronounced, but equally important as evidences of anticlines, are the Jebel Qaiarah, Jebel Misrak, Jebel Makkul and other hills, west and east of the Tigris, with the same general trend, N. to S., or N.W. to S.E.

The chief mineral wealth of the area is in the springs of oil, which were famous even in the olden days, and centuries of leakage have not diminished their value. The ancient oil-springs were at Hit, Kirkuk and Jibbah, and these same areas are the most promising fields to-day.

The principal oil-bearing strata are the porous "Asmari" limestone beds, which are similar to the oil-bearing limestone, of Miocene age, of the Maidan-i-Naftun oilfield in Persia. The "Asmari" limestones form part of the "Fars series", which consist besides, of beds of gypsum—sedimentary deposits—and beds of sandy clay, often stained red with iron oxide, which alternate with the gypsum and limestone. The "Fars series", together with the "Kurd series",—a zone of later fresh-water formations comprising red clays, sandstones and conglomerates,—form the Tertiary rocks which have been compressed into anticlinal folds and subsequently buried under the alluvium of the constantly expanding delta. Where the anticlines have been eroded by streams, as in the gap cut by the Tigris across the Jebel Hamrin, are found seeping tarry oil and bitumen, containing yellow sulphur, and giving off a strong odour of hydrogen sulphide.

Oil pools exist in several localities where geological conditions have been favourable for their formation. The chief modern wells are situated S.E. of Mosul, on the Jebel Hamrin anticline, which is eminently suitable, except at its south-eastern end, for the occurrence of an oilfield comparable with the best Persian ones. The wells are served by the Diyala valley railway, which connects them by way of the Khaniquin branch, with the great refinery at

Alwand. In the anticlines west of the Tigris, as far north as Mosul, viz., in the Jebel Qaiarah and the Jebel Misrak, bitumen is common, and has been much used; and German borings both before and during the Great War showed that an important oilfield is situated there, most promising near Nimrod and Hammen Ali. In the Quwair field, south-east of the junction of the Great Zab with the Tigris, where a dome-structure is apparent, have also been noted seepages of black tarry oil and numerous other evidences. The very ancient oil seepages at Kirkuk, where the first modern well was bored in 1927, were utilised by the local Arabs, one of whom obtained regularly 48 kerosene tins full daily from one pit. Here the structure however, is not ideal. The S.W. limit of the Kirkuk anticline is hidden under the Mesopotamian alluvium, and evidence suggests a probable reversed limb, or anyway a steep limb ; borings could therefore easily miss the oil pools. The oil locality of Tuz Khurmatli, which has been known for a long time, also has a complicated structure, namely an anticline running S.E. to N.W., with reversed limbs, especially the south-west, and much contortion and reversed strike faults. The old wells were large pits dug near natural seepages on a line very close to, or else just south of, the axial plane of isoclinal subsidiary folding occurring in the north-eastern flank of the main anticline. A very narrow field with capricious oil-pools tapped by rapidly declining wells is all that can be expected.

The oilfields of first class importance are those of " Qaiarah " and " Quwair " ; the Jebel Hamrin, Jebel Misrak and Kirkuk areas are of secondary value, and the others less promising and more risky. The similarity of conditions between Iraq, India and Burma,—a petroliferous series, containing saline products and marine fossils indicative of a dessicated gulf, and followed by a fluviatile deposit—suggest that Iraq should rival Persia and collectively outclass Burma.[1]

The story of the exploitation of Iraq's oil is a long and involved one. As early as 1904 there was rivalry between German, Dutch and British capitalists, which continued until 1914. The territory was Turkish ; the oil surveys were German ; but the British were interested in Persia, being in 1913 the controlling influence in the Anglo-Persian Oil Company. The Turkish Petroleum Company, however, obtained a concession from the Ottoman Government for the exploitation of the oil resources in the Baghdad and Mosul vilayets. In 1914 the Anglo-Persian Oil Company held 50% in the new concern, the rest being divided between the German and the Dutch. In 1920, in the post-war settlements, the concession was inherited by the Iraqi Government and became known as the Iraq Petroleum Company (the I.P.C.). The German interests were trans-

ferred to France, apart from 5% still held by the original concessionaire, with transport rights to Syria. America protested and obtained 25% of the British share. Hence 95% was divided equally between British (Anglo-Persian Oil Co.) American (Near East Corporation), Dutch (Royal Dutch and Shell), and French (a Franco-Belgian group) interests. The settlement of the exploitation problem is the concern chiefly of Iraq ; but she is too poor to borrow money on favourable terms; the annual budget deficit has to be met by British Government; public opinion is opposed to foreign exploitation, but as it depends for developments on foreign capital, it must accept the terms. The problem was settled in 1925 when it was finally agreed to test and exploit measured plots. The question was reopened in 1929, and in 1931 the concessions were confined to an area between the left bank of the Tigris and the Persian frontiers; the plot system was abandoned, and the pipe line to the Mediterranean determined upon; and the royalties ultimately fixed.

Since then the Iraqi Government has concluded a similar agreement with the British Oil Development Company (or the Mosul Oilfields, Ltd.), whose concession area lies west of the Tigris. It is still prospecting. Another oil company is the Rafidain Oil Company, known until 1931 as the Khanaquin Oil Company (the K.O.C.), a subsidiary of the Anglo-Persian Oil Co., set up by the latter on Iraq's insistence that if it meant to operate in Iraq, it must do so by means of an Iraqi company, and with a concession from 1926 to 1969. The producing field is at Naft-Khana at the Persian border.

In the Persian Gulf area, too, there is a keen fight for oil in progress, especially on the Arabian side of the coast. The Bahrain concession has gone to "Caltex," a joint concern of the Standard Oil Company of California and the Texas Corporation, two of the biggest producers and distributors in the United States. The cost of production in this concession is lower than anywhere else in the world, because the oil is produced and delivered at sea-board. The rapid development (from 3,600,000 barrels in 1936 to 6,000,000 scheduled for 1937) is causing considerable concern to the British Oil Development Co., and other ventures, particularly in view of the competition for the Indian market. These figures may be compared with the Iraq production of 4,100,000 tons in 1936, and in 1937, out of a world total of between 240 and 280 million tons. (1 ton=7 lbs.)

A most interesting feature of the petroleum development in Iraq is the great pipe-line to the shores of the Mediterranean, costing about £10 millions, and designed to avoid payment of Suez

Canal dues on the oil shipped to Europe, which was completed in January 1935. It starts at Kirkuk, the first of the twelve pumping stations along the route, and is one of the most modern and most efficient in the world, equipped with the latest machinery.[2] A double line takes the oil across the Tigris and the Euphrates to Haditha, about 156 miles south-west. Thence the line forks, one branch bearing slightly north of west through Syria and Lebanon to Tripoli; the other goes south-west into Transjordania, turning north-west at Mafrak to reach the coast at Haifa, from where the main output of about two (2) million tons will be distributed. The 1150 miles of pipe-line run mostly across desert wastes, where construction was possible only with the use of motor lorries, caterpillar tractors, mechanical excavators (the "ditcher" used to cut the trench for the pipe-line could dig a trench 2 feet wide, 6 feet deep, and 1 mile long per day) and similar mechanical aids. And it now forms, by means of the telegraphs lines following its course a new route which is rapidly becoming one of the normal moto routes to Iraq.

The borings in Iraq as a whole have not confirmed the belie that it has oilfields of inestimable value; those of the I.P.C. particularly have not fulfilled the hope of either the company or th Iraq government. Nevertheless, this company, together with th K.O.C. are of the greatest economic importance to Iraq, for, excepting the Government, they are the largest employers of labour i the country. The capital invested is large, and the dues all go t Iraq. The new company, the B.O.D.C. under the chairmanship c Lord Wemyss, but chiefly Italian, Swiss and German, promoted be cause the rate of development of the I.P.C. and K.O.C. was nc quick enough, has been a source of trouble to Iraq. Internation group rivalry makes the position difficult, as the large English an American companies do not favour rapid exploitation of the Mos oilfields, but prefer to retain them as reserves, in order to avo increasing the already large supplies of oil in the world's market

"Although oil has made a dramatic and highly spectacul entry upon the scene in Iraq, agriculture, as always in the past, wi remain the staple industry of the country."[3] The climate of Ir tends to great extremes, though it is of the Mediterranean typ The average rainfall is less than 10″ per year, and very variable the whole year's rain may often fall in 26 days at the most. Hen irrigation is absolutely necessary for cultivation, except in the e treme north, where the slightly heavier rainfall (12″) is sufficie for the winter wheat crop.

The great civilisations and the cities of fabulous wealth whi Iraq supported in the past, were all directly dependent upon org ... systems of irrigation. The total area once irrigated in Bab

lonia has been estimated at 5 to 6 million acres. The average combined discharge of the Tigris and the Euphrates would irrigate 7 million acres in winter and 3 million acres in summer. Half of this could be immediately reclaimed if the ancient systems of canals were restored, with adequate drainage, and the Euphrates water turned into the land west of the Tigris, and the Tigris and its tributaries into that east of the Tigris. It is suggested that navigation should be deliberately impeded, and the railways substituted for rivers for transport purposes, and the whole of the water used for irrigation.

There are three main difficulties to be overcome; flood, silt, and waste. Under the present system of storage in the plains, some 75% of the water is lost by evaporation; and a large proportion of the flood waters also lose their way in the malarial swamps.

Almost yearly the conditions of the twin-rivers alter, particularly in the Tigris into which enormous quantities of silt are brought down with the spring floods by the Zagros tributaries, e.g., the Diyala, which has turned the main stream steadily westward towards the Euphrates. The southern tributaries form individual deltas as they approach the Shatt-el-Arab, especially the Karun. The Euphrates does not receive such mountain tributaries, yet the main stream brings down similar quantities of mud and in its lower course has many shifting branches across its alluvial deposits: marshes, lakes, and other marks of abandoned courses are found along the whole of the 300 miles of its lower course. On the whole this river tends to push itself westward, so that the true "Mesopotamia" or "land between the two rivers" has been greatly widened through the centuries. On such a plain the difficulties of building and maintaining irrigation canals must have been exceedingly onerous. Here is an explanation of abandoned cities and of declining centres of civilisation. The modern engineer's efforts, too, have to deal with these rivers' waywardness, in reviving the long-decayed systems.

A modern system to irrigate north of Baghdad follows a similar plan to Nimrod's famous dam; but the notorious Hindiya barrage on the Euphrates differs from other attempts, both ancient and modern, to regulate the Mesopotamian rivers, in that it is more a regulator of flow than a mere passive obstruction. The discovery of the Habbaniya depression and lake, west of the river, made it possible to construct an escape regulator, to divert the surplus flood waters from the Euphrates into this natural reservoir during the great spring floods, and to return it later, during the dry summer. Further south on the Tigris is the Kut barrage, to divert the surplus water into one of the ancient channels, the Hai or Gharraf.

Its effect, when the scheme is completed, on river navigation, has perhaps scarcely been fully considered.

A significant development under the Irrigation Department of the new Government, is a system for the collection and distribution of news concerning rainfall in the mountain areas, and the possibility of flooding in the plains. The Franco-Syrian authorities supply, by wireless, readings of the Euphrates at Jerablus and Dair-es-Zor, thus giving five days' warning to those in Iraq of what is in store for them south of Ramadi.

The various irrigation schemes, fostered and protected by Government, will make Lower Iraq, where the soil is a fine silt, a fertile river alluvium, an extremely productive area. Winter crops, like wheat, but especially barley and beans, will be possible; and summer crops of cotton and millet under "dry" treatment, and rice and dates under "wet" treatment. The area which can be cultivated in winter is eight times larger than that possible in summer. In 1918-19 the area under both was 1,500,000 acres, of which only 200,000 were under perennial irrigation; this in 1927 had been increased to 500,000 acres.

The riverine tracts can be developed piecemeal by lift irrigation in a comparatively short time; it is estimated that they include between 300,000 and 500,000 acres which are too high-lying to be irrigated by the canals of the larger projects. Pump irrigation could be more widely utilised, with the supply of cheap fuel oil from Khaniquin. The artesian water supplies recently found in Upper Iraq may also be used, if they prove to be abundant, for developing perennial cultivation based on irrigation.

One of the crops most dependent upon irrigation is cotton, a new introduction as compared with cereals. It was first grown by the Germans in pre-War times, but was limited to Upper Iraq especially the Zagros basins: the fibre obtained was coarse and poor. Climatic conditions are more suitable in Lower Iraq, where its cultivation is now making steady progress, although hindered by present world economic conditions. During the short growing season there is a high and rising temperature, with none of the cold from which both Egyptian and American cotton suffer. There is no fall in temperature until after the period of growth, when the sharp autumn fall helps the ripening. There is no summer rain but there is sufficient moisture, when most is needed, from March to June. Especially around the Hilla Branch, the soil, a yellow variety, is very suitable. The Baghdad experimental station shows a very high yield, of goood staple, 1-1½". The Egyptian type grown in Iraq equals that of Egypt in quality, both in length strength and fineness. American varieties acclimatised in the

Punjab, are also grown, especially on 200,000 acres of the Diyala flood plain. Until recently the whole of the cotton passed through the hands of the British Cotton Growing Association, who, at one time possessed the only ginnery, capable, however, of dealing with 10,000 bales a year. When the outlook was most promising much money was invested in a rival concern, although the British concern was not a profit-making one ; and the result is that neither is doing well, and the British one may withdraw.[3]

The rival to cotton is rice, the main grain crop, increasing as a local food, though being rivalled by maize. It is grown for both home consumption and for export, mainly along the banks of the river marshes in Lower Iraq, especially near Basra, but also in Upper Iraq. It is usually grown during the second growing season from August to November.[4] The other grains include wheat, especially in the North, where there is a better rainfall, and it is harvested in early summer ; it is mostly of the hard, poor and coarse variety, but better white varieties are being introduced. Maize, millets and sesame are grown in Lower Iraq ; opium, hemp, lentils and liquorice root are the products of the Shatt-el-Arab region. Barley was of great importance in pre-war times and exported in quantities from Basra ; it is the safest winter cereal because it needs a shorter growing season ; it is also less liable to disease, and more capable of standing excess salts.

It is estimated that 90 millions or over 1/3rd of the date palms of the world are grown in Iraq, 15 million on the Shatt, 5 million on the Hilla, 1 million near Baghdad, and the rest along the Euphrates and in oases ; producing about 400,000 tons annually, or 80% of the world's supplies. The physical possibilities of this crop are almost unlimited, and the supply of labour sufficient. Water must be abundant, but protection from flood available : so long as the ground is well cultivated for subsidiary crops, they will flourish, whatever the character of the soil or water. With the increasing population the local demand is increasing too. It is interesting to note that each season ship after ship goes to French North African ports with dates from Basra, which thus supplies all the Basra dates on the market, and a portion of "Tunis" dates as well. The annual export of 100 to 150 thousand tons, varies according to price from £1,500,000 to £2,000,000 in total value. It is a highly organised trade, with world-wide ramifications. A board is considering recent developments in the fruit markets of the world, and advising the Government as to new avenues of trade and research.

The break-up of the Turkish Empire at the end of the Great War left behind it the medley of races and cultures which had comprised it, as a legacy to the several independent political units

into which it was split up. This complexity was specially characteristic of the corridor between mountain and desert, into which migratory movements have brought many different types—basal Eurafrican, Semite, Sumerian, Medes and Persians, Mongoloid and Turk invaders, and lastly the Greeks and Armenians in quest of trade, and the "Turkish" officials who spread everywhere throughout their empire under the Ottoman government. Islam has been the only really unifying influence, and the Arabs who brought it have consequently enjoyed a cultural and linguistic influence even more preponderant than their numbers. When this corridor was reconstituted into "Mandates", "in Mesopotamia, as elsewhere in the East, every element in that complex began to acquire a less indefinite and more crystallised form", probably because of the political doctrine which had led to the establishment of Mandates.

Some of the problems arising from this complexity were made still more difficult of solution by the way in which the frontiers had been delimited in some places; the boundary settlements were often more influenced by the fears and ambitions of the European powers which took part in them, than by a genuine interest in the welfare of the people concerned, as for instance the Kurds. They form the majority of the 800,000 inhabitants in the Mosul vilayet of Iraq, while the rest of their "nation" are still in Persia (1 million) and Turkey (1½ millions). These people, very distinct in character from the Arabs, are still in the tribal stages, with an undeveloped national consciousness as compared with the Arab, and no "national" history. They inhabit the mountain areas to the north and east of the Upper Iraq plain which they constantly raid, and they prefer their unsettled pastoral life to the agricultural settlement so necessary in an organised state. In Turkey and Persia the Kurds have had to merge with the rest of the people, and thus be denationalised. But in Iraq, a semi-autonomous Kurdish state has been set up, within the Mosul vilayet; and th opportunity, thus provided, for Kurdish national sentiment to deve lop, serves to foster their dream of a "Kurdistan" uniting th minorities in the three neighbouring countries.

Mosul is definitely an Arab town, in spite of the vilayet bein mainly Kurdish. This region is the richest grain-growing distric of Iraq, but the area to the west of the Tigris, and towards th south, is largely inhabited by the Bedouin Arabs, who are eve more truly nomadic than the Kurds. Therefore Iraq, and Mosu in particular, has to cope with an encroachment of nomadism fron two opposite directions. The distinction between the true Bedoui of the desert and the agricultural Arab is, in fact, very marked though both would appear to belong to the same physical type The basic problem of the Arab nationalist movement is really th

rapprochment between Bedouin and settled Arab, for "to the extent that the population becomes agricultural will the nation acquire stability." Ibn Saud has shown, by his Ikhwan colonies in the Nejd, that the Bedouins are ready for this transition to a settled peasant life; therefore Iraq's hope for the future lies in the policy of slowly extending irrigation and persuading the nomadic tribesmen to settle on the land. Iraq has had direct dealings with Ibn Saud himself, over this same problem of the wandering Bedouin, in order to reach a settlement of a common frontier; and it has been satisfactorily solved, by allocating the actual tribes, instead of their territory, to each of the two states, and by regulating their migrations.

The creation of modern Iraq is something more than a response to the demand of an awakening people: it is the result of long years of international dispute and rivalry. Iraq flanks the land route to India; for more than 150 years Great Britain has been in virtual domination by reason of her supremacy in the Persian Gulf; she has, nevertheless, constantly endeavoured to control the route through the Fertile Crescent. Russia has desired to control Persia or Mesopotamia in order to obtain a warm sea outlet and a possible area of tropical production. Parts of the Baghdad Railway and sections of the Basra and other docks still remain as tangible evidences of the pre-War German schemes for expansion, which schemes still dominate Hitler's aim of Nazi imperialism in the East.* France, ever desirous of Syria and other old Crusader lands, would have liked to extend her influence eastwards also. In the post-War period, the diplomatists of the Great Powers once again turned their covetous eyes to this unique valley of the two rivers.

The ancient land routes have recovered some of their former importance, with the advent of air transport and the development of desert motor services—the Baghdad-Damascus motor service takes less than twenty-four hours. They have thus gained in strategic value at the expense of the Suez route. Despite the changes in methods of transport, the routes followed are very much the same as in the past. The old caravan routes still prosper side by side with the railway, while some are followed by modern roads. The chief caravan centres are Mosul and Baghdad: the former is really the starting point of the well-known

* "We National Socialists have deliberately drawn a line under the pre-war tendency of our foreign policy. We are where they were six hundred years ago. We stem the Germanic stream towards the South and West of Europe, and turn our eyes eastwards. We have finished with the pre-war policy of colonies and trade, and are going over to the land policy of the future." A. Hitler: "My Struggle" (English Translation of "Mein Kampf") p. 258.

Aleppo route via Nisibin and Mardin, or alternatively to Erzerum. Five main routes diverge from Baghdad : the route to the pilgrim towns of Kerbela and Nejef and thence southwestward across Arabia to Riyadh, Jauf, or Hail, to Mecca and Medina; westwards across the Syrian desert to Beirut, Haifa and Egypt ; northwards via Mosul to Damascus, Aleppo and Istambul ; northeastwards to Teheran and thence to Turkestan and Central Asia ; and eastwards to India, either along South Persia, or the Gulf.

The lines of the Iraq railways cover most of the country, and are a War-time and post-War growth centred upon Baghdad. The last link of the famous "Berlin-Baghdad railway" still remains incomplete : the direct route for the Mosul-Baghdad section was abandoned, and an alternative more northern route via Kirkuk, passing through more productive country was chosen ; but recently the original project has been revived and construction continued on the final section, between Shargat and Mosul.

Baghdad has also become one of the principal airports of Asia during the last ten years : over it pass the French route to Saigon, the Dutch route to Java, the Imperial Airways' route to India and Australia, the Junkers' route to Teheran, and other routes to Europe via Baku and Moscow. "The intense rivalry of the European powers interested in the Hither East before the World War in the field of railway construction is celebrating its resurrection in the air."—British oriental policy, which has been determined for the past 150 years by care for the defence of India, and its sea communications, has been confronted since the World War with the tasks of exploring new paths. Instead of the establishment and defence of coaling stations, the requirements of the near future will be the protection of the oil supply.

It is held that Iraq has been made independent too soon, and critics who prophesied failure in what has frankly been admitted to be an experiment, have pointed out the economic weaknesses, the difficult domestic and external political circumstances, and the lack of experience, in the people themselves, of self-government in any form. The experiment has not failed, so far, in spite of the untimely death of King Feisal, whose great influence was one of the most important unifying factors in his country.

The contact with European civilisation has produced in Oriental countries several new currents in the life of their peoples. They have readily recognised the superior material wealth and power of the West, and, desiring to possess and enjoy both, they have tried to copy Western civilisation, and chiefly Western modes of life. This wholesale Europeanisation is, at the same time, strongly opposed by an intense dislike and distrust of all things European, which has its roots in the desire to be rid of European political

tion and Western political ideals to the East, and these are responsible for the growth of nationalism and the urge to reform society and religion. The rising spirit of nationalism has frequently been allied with the dislike of European domination. Social and religious reform movements tend to emphasise the importance of individual freedom, and favour the growth of secularism, and an increasing opposition to traditional social and religious institutions. All these tendencies are to be found in the Near East.

'Arab nationalism is closely interwoven with Pan-Arabism. The historic meeting between Ibn Saud and Feisal in 1930 was an example of this new spirit in Arab politics, and among its first-fruits was the treaty between Ibn Saud and Iman Yahya of Yemen, concluded in 1934. In its preamble it is described as a " treaty of Muslim and Arab brotherhood to promote the unity of the Arab nation." Both parties declare that "their nations are one, and agree to consider each other's interest as their own." The artificial character of the present political frontiers and of the political structure of several Arab states, are two of the factors in favour of a Pan-Arab federation. A closer union among them seems to be precluded by the inevitable conflict between the intensely religious and puritanical outlook of the Wahabis of Saudi Arabia and the secular, materialistic attitudes of the peoples of the other, especially the more prosperous and wealthy, Arab states, like Iraq and Syria. In Iraq there will also be the conflict between this same Wahabi puritanism and the Shiah community, who form a large proportion of Iraq's population. Ibn Saud has been able to hold the desert tribes by the magic of his personality, and even weld them together into a united nation. The tasks of merging them into a larger whole in which they will not always be the most important section, and particularly of reconciling them to live in peace alongside others with a different religious outlook, will be more difficult than anything he has done so far. It seems likely, therefore, that Iraq will continue to exist as an independent state.

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A good Atlas, as the Oxford Advanced Atlas, should be used in studying this paper.

Extracts from Periodicals

THE E. I. RAILWAY DISASTERS

A Scientific Examination

(Extracts from "The Labour Times" of Madras of March, 1939.)

Yet another serious Railway disaster has occurred on the E. I. R., this time near Hazaribagh Road, on the 12th January 1939, bringing the major disasters to five in the course of 18 months. This cruel repetition is terribly alarming. Travellers going into the trains in these parts get panic-stricken and uncertain of reaching their destinations. It is a pity that the safest of all modes of travel should, on the sudden, be felt to turn out so perilous.

'Sabotage Theory' Questioned

Sabotage is a theory that comes handy in these enquiries, but the concentration of these disasters both in time and place in an area where anything but minor accidents have not been previously reported, and the absence of any intelligible reasons assigned for sabotage, give ample room to enquire if there may not be intelligible physical causes at work behind these disasters.

The times are normal with no discontentment assignable anywhere, and sabotage uncoupled with some general discontent has become almost unthinkable in the remarkably quick succession of these South Bihar disasters, the most terrible of which are to be located in the vicinity of the southern bank of the Ganges.

The details to be found in the press regarding the Hazaribagh disaster, are wholly unintelligible on any theory of sabotage. The tender and not the engine in front of it is said to have derailed, and 4 bogies and not another between them and the tender, and in the same way certain bogies behind, to the exclusion of their neighbours, are said to have capsized, and one of the rails is said to have been recovered from a distance.

As regards the Bihta disaster too, the blame was sought to be thrown on the XB class engines, but these are to be found working without complaint on other railways.

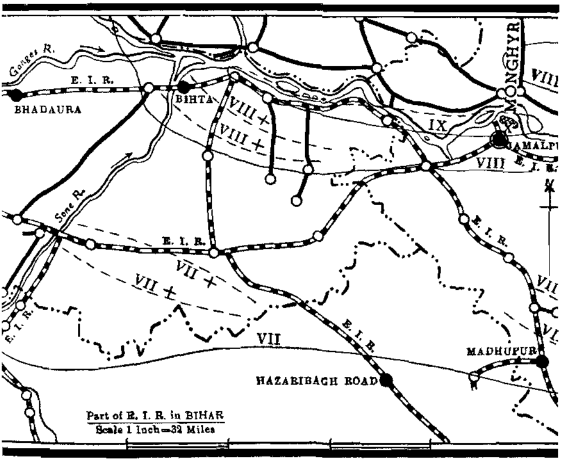
Let us look for causes elsewhere

The aim of this article is to investigate how far the available data about the hypogene forces at work in the area shown in the map below might afford a solution of this moot problem.

Earthquake Belt

The Indo-Gangetic plain that lies between the stable peninsular mass on the south and the upheaving Himalayan ranges on the north, is the earthquake belt in India which has been passing through a period of marked earthquake activity. It consists of alluvium to a depth of 1,000 feet and more, the result of pleistocene deposition; it is thus an unstable mass easily disturbed by earthquakes that, in their origin, are connected with the orogenic movements still going on in the Himalayan region.

Seismic Map of 1934 for the region of the Recent Railway Disasters.



Note.—Black dots show places of disasters. Curves in thin line numbered in Roman letters VII to X are Iso-seismals of 1934 on Mercalli's scale.

(By courtesy of 'The Labour Times.')

The period since 1897 has been one of special seismic activity, in which year occurred the great Assam earthquake followed by that of Kangra in 1905.

The previous noteworthy disturbance occurred in 1833 and in the same area as that under consideration, namely Bihar. The accounts relating to it make it probable that it was not as severe as that of 1934, but at any rate no sufficient statistical data have been preserved. This is rather unfortunate, as from several simi-

larities that it possessed to the earthquake of 1934, data if they had existed, might have proved of great use for the present problem.

Article based on Official Investigation

As a subject of research, Seismology has to date in India from 1897, *the year of the Assam catastrophe.*

The study in this article will be mainly based on the detailed official investigations of the seismic zone of Bihar conducted by Dr. J. A. Dunn and Messrs. J. B. Auden and A. M. N. Ghosh of the Geological Survey of India soon after the earthquake of 1934. The map of the area appended to explain this article is one mainly adapted from their reports.

The greater part of Bihar occupies the lowest position of the Gangetic plain before it merges with its delta. On the south, the north-easterly trend of the Chota Nagpur Hills reduces the width of the plain from 200 miles in the west to 100 miles in the east. The Ganges divides the plain into two portions, a northern and a southern.

The northern division consists entirely of alluvial soil composed chiefly of loam and layers of water-bearing sand of unknown depth.

The major epicentral tract of the 1934 earthquake lay in this area and here all communications were nearly destroyed. The report of Mr. J. Williamson, Agent to the Bengal and North-Western Railway admirably sums up the damage done to railways within the isoseismals X and IX on the Mercalli's scale. "Over 900 miles of the permanent-way—1/3 of the entire system—hardly a mile of track was undisturbed. Many of the major bridges collapsed, such as the Inchcape Bridge on the Gogra and the Bur Gandak near Rushera Ghat. Hardly a culvert could be used until it had been examined and repaired. In all 361 bridges and culverts were destroyed or damaged Embankments slumped or even disappeared, the rails remaining suspended; elsewhere they were raised or shifted many feet laterally. The permanent-way even when least distorted, may be likened to a construction line on a high new bank which has passed through a heavy monsoon without attention. So severe is the distortion in places that a trolly could not be safely taken round the kinks."

In south Bihar, the country between the Ganges and the hills of Chota Nagpur, where all the railway disasters are localised, is similarly alluvial in character but the alluvium is chiefly argillaceous and the various outcrops quite close to the Ganges indicate that its depth is not as great as in the north. The principal towns ... of Gaya, which lies among rocky hills south o

the river, Patna, Monghyr, Bhagalpur, Arrah, Bihta and Bhadaura lie on or in close proximity to the Ganges.

The visible destruction due to the 1934 earthquake in this region was mostly confined to masonry constructions.

To correctly estimate the causes of the disasters, it would be necessary to study the higher isoseismals on the Mercalli's scale demarked on the region.

The elongated elliptical shape of the isoseismal IX that would define the epicentral region in our area immediately dispels all doubt regarding the geological significance of the earthquake. All the isoseismals suggest that the earthquakes are due not to any volcanic but only to tectonic causes operating along a linear epicentral region arising out of a sudden fracture or fractures below the Gangetic alluvium, or from some movement along pre-existing fault planes. There are possibly two zones of fracture one below Motihari-Purnea zone and the other below Patna-Monghyr Zone.

Isoseismal lines on a map of an earthquake-ridden locality serves many useful purposes. Apart from providing information for insurance folk, they give warning that buildings, bridges, dams, embankments etc., must be designed and erected with a full knowledge of the seismic activity of the area. They show that unfavourable locations such as fault zones, sloping ground such as river banks. and the proximity to junctions of different types of formations are to be avoided: For example, Monghyr and Jamalpur seem to suffer more from earthquake shocks from whatever directions these come from, than other places in their vicinity. This has also been by *some ascribed to faults at the junction of the alluvium* with the Archaean basement.

In Japan important work has been done with regard to earthquake proof structures. Every type of construction includes a seismic factor i.e., resistance to a possible horizontal acceleration, which has been strictly enforced. In Quetta it is said that a seismic factor of 4.8 ft./sec.^{2} or that usually attained in IX of Mercalli's scale, has been laid down, after the earthquake disaster of 1935, as the acceleration to be reckoned against in respect of the constructions of the military department. All countries like Japan, New Zealand, Mexico, California, Italy and Greece have enforced with great benefit seismic factors for constructions and it becomes all the more necessary to adopt similar measures in parts of India subject to severe earthquakes, if catastrophic accidents and losses are to be prevented in the future.

The isoseismal belts marked in our area may now be taken up and the concomitant phenomena observed in each noted, for it is from these that practical conclusions can be arrived at for sug-

gesting remedial measures. Isoseismals lower than VII on the Mercalli's scale are left out of consideration as they are outside of our area and their damaging effects are not at all alarming.

In Bihar there are two tracts where the intensity reached the degree of X i.e., where the acceleration reached 3.2 metres/sec^2. The bigger lies in North Bihar, extending from east of Motihari to Madhubani, where the railways have suffered incredible damage and with reference to which the Agent's report has been quoted above. Fissuring of the ground in this belt was severe and emission of sand and water reached its maximum. The "slump belt" of Dr. Dunn encloses this belt which again is encompassed by that of IX. In the slump belt the constructions slumped bodily into the alluvium. Subsidence of roads, causeways and railway embankments were marked. The effects of slumping were more marked along low lands, marshes and near the edges of rivers, lakes and tanks. The bench-marks mostly made on abutments of railway bridges sank one foot and over. Enbankments originally 6 feet high were found at ground level and borrow-pits alongside the roads and causeways subsided. This was brought to light by the re-levelling of the Survey of India that immediately followed the earthquake. Screw pile bridges fared better although many of them were severely twisted and buckled.

Another zone of fracture where the intensity reached 3.2 metres per sec. per sec. is between Patna and Monghyr. It was probably secondary and may have been the effect of disturbances initiated below the epicentral tract relieving subsidiary zones of strain. At Monghyr the buildings were practically razed to the ground as the town is partly built on Archaean rocks. Here the devastation was especially spectacular on the alluvium. The immediate vicinity of Monghyr alone comes in this belt and is marked X in the map. Neither fissures nor slumping of the ground were noticeable except near the edge of the river on the north.

There are three areas of severe intensity equal to IX with acceleration 2 metres per sec. per sec. bounded by irregular elliptical curves, and the two most important occur in Bihar. The larger of the two occurs in North Bihar which encloses the slump belt and is not shown in our map. It extends from Motihari to Purnea. The slump belt is completely enclosed by this isoseismal. The damage was on the whole similar to but less intense than that in the more localised region of isoseist X.

Prominent fissures and faults in the alluvium were generally confined to the vicinity of such depressions as rivers and lakes. Emission of sand and water was also prominent. Regional subsidence and slumping, being functions of distance from the focal area, appeared to be moderate in this zone. The harrowing tale

of the Agent of the Bengal and N. W. Ry., in regard to this zone particularly concerns the railway.

A narrow zone however of the same intensity as IX extended from Patna to Monghyr and is to be found in the appended map. The major axis of this ellipse follows the direction of the flow of the Ganges. This curve cuts away the northern salients of the Ganges. The important places affected in this zone are Patna, Barh, Jamalpur and Monghyr. In Patna the worst damage took place along the river front. So also at Barh, the effects were more pronounced as the river was approached. At Jamalpur the disaster was most acute surrounding the railway station.

The isoseist of the next lower intensity VIII with an acceleration of 1.5 metres per sec.^{2}, is well demarcated and forms a wide belt round the higher ones and covers an area of 31,000 sq. miles. In this area the railway bridges and permanent way suffered considerably but not to the same extent as within IX and X. A number of buildings collapsed in this belt but damage due to the slumping and subsidence was occasional. Fissures and sand vents occurred sporadically north of the Ganges.

The important towns situated near its edge are Bhagalpur, Bihta and Bihar. Only a few days back it was reported on the 6th February, that at Bhagalpur a serious accident was averted by the engine driver noticing in time boulders on railway track. Though a case under Railway Act has been instituted against 'unknown person' the police themselves are understood to be of the opinion that the incident did not amount to a deliberate attempt at sabotage. It would appear to be reasonable to expect an accident at Bhagalpur due to its nearness to the river, from slight disturbances in the alluvium leading to slight changes in the railway embankment and to its general similarity to Monghyr, Hazaribagh and Madhupur in the alluvium meeting the solid gneisses of the fringe of the much dissected Chota-Nagpur plateau. At this place during the earthquake, the river became dry for a few seconds. It is along the line of continuation of epicentre, and temporary unlift of the river bed would fully explain the phenomenon. Mr. J. Williamson, Agent of the B. N. W. Ry. was an eye-witness at Monghyr and he saw the bed of the Ganges run dry for a few seconds. At a few places along the Ganges the water piled up along the south bank.

In this neighbourhood 30 miles off along the direction of the major axis of the epicentre from Bihta, is Hilsa within the same zone; here have been reported cases of subsidence of buildings, fissures and sand-vents. This is mentioned as such occurrences have not been observed in other places to the south of the Ganges. It sug-

gests the Bihta region of ill-fame to be one of special significance marked in the map as VIII *plus*. A report about this disaster says "after the derailment the track was found to have been distorted for several inches on each side from the correct alignment. This was on sleepered track but the actual derailment was on plate sleeper track rigidly held both horizontally and vertically.' This seems to favour a theory that would rest on normal causes germane to ground that had suffered a violent earthquake.

In circumstances of so much disturbance it is not unnatural to suppose that the region should take time to settle and give rise to attendant railway disasters—a fast moving train being susceptible to the slightest movements of this kind of readjustments.

The last belt of any importance in our area is VII on the *Mercalli's scale*; it appears to have been constructed, except as to its southern boundary (which Dr. Dunn had aligned from data personally collected by him), from out of an earthquake-questionnaire. This isoseismal VII is far away from the epicentral tract and therefore the destructive power of the earthquake becomes visibly less. Inside the zone of this isoseismal a detailed enquiry has still to be made before the violence of the shock could be properly appraised.

Two isolated zones of increased intensity VII *plus* occur within this isoseismal; the westerly of the two includes Gaya and the other is in the Santal-Parganas, through which the Chota-Nagpur plateau extends to the Ganges on the north-east. Madhupur is midway between VII and VII *plus* in Santal-Parganas at a junction of the alluvium with the Archaean rocks of the plateau with an elevation of 820′ above O.D., and much resorted to for its quiet surroundings. The official verdict of the enquiry over the railway tragedy here is again sabotage viz., "A rail had been removed and fish plates laid across the track." But this verdict would appear to stand on no better footing than that of Hazaribagh to which we shall next proceed.

Hazaribagh Rd. is situated just outside VII and within VI and the verdict in question has in its favour the circumstance that within VII itself the outward appearances of constructions give no hint of an earthquake having taken place. But this is no criterion of safety so far at least as moving trains are concerned. This is amply shown by phenomena observed outside belt VII. The mine areas are situated within VI and in the majority of them a large influx of water 50 to 400% above normal were reported sometimes through old fissures that had been dry for years; the rise continued for some time after the shock and the conditions were not restored to normality even after the lapse of months.

This shows how far the underground circulation of water had been disturbed and how great the consequent weakening influence on the alluvial strata in these places by way of increasing their porosity, must have been. Besides this, well attested surface undulations have been observed for example at Asansol.

At Hazaribagh we are on ground that has many parallelisms to Monghyr. In both places the alluvium is on its way to join solid rocks of the Archaean gneisses etc.; the difference between the two seems to be that Monghyr is on the epicentre and if Hazaribagh has not suffered much till now, that is only due to its being far away from the epicentre where changes and adjustments are likely to take place but slowly and imperceptibly.

It is thus probable that this disaster may have been due to some sudden oscillations of level beneath the embankment which might have disturbed the rails over it as the train was moving with high speed.

The circumstances in which this disaster has come to join the others nearer the Ganges bank, would seem urgently to call for an intensive study of the geomorphology of the locality with a view to lay bare its geological structure, especially as the results would make us understand the measures necessary for making the permanent way safe. Until this is done the better course would seem to be to deposit the verdict given (of sabotage) in a, so to say, suspense account.

In reinforcement of the idea that Hazaribagh is not as safe as the VII isoseist would make it out to be, it has to be pointed out that Allahabad is on this line and that the unreliability of it, has been emphasized in the report in these words: "Nevertheless such large towns as Mirzapur, Benares (where just as this article is in the press, an averted disaster has been reported on the 15th Feb. at Kylahat near Mirzapur) and Allahabad evinced a certain amount of major damage of the nature of collapsed houses, fallen chimneys, and severe cracking of walls."

Finally certain conclusions reached in the official report may here be gathered together.

The general form of the isoseismals show that the region between Gaya and the Himalayan Foot Hills is liable to shocks in the future, and no zones in it can be marked as possessing more safety than others.

The magnitude of the slump belt shows the alluvium has received a most severe shaking and irregular subsidence may continue for sometime to come; and the absence of fissures etc.,

is no criterion for the absence of sub-surface dislocation and relevelling from time to time is necessary in the epicentral track.

In alluvial country after an earthquake, appearances of subsidence and non-subsidence are quite deceptive as to stability or otherwise and no heavy structures should be erected within at least 200 yards and more from depressions in the epicentral track; and, as a consequence, deep trenches and borrow-pits by the side of the permanent way should be avoided as otherwise the embankment is likely to sink.

It is likely that banks of rivers have shown a tendency to close inwards and very great care should be exercised in putting up constructions there; and it is a clear warning here that all the Railway Disasters have occurred on the Ganges bank.

Masonry piers and abutments should have an acceleration factor of 10ft. per sec. per sec. in all directions.

It may here be pointed out that the calamitous earthquake that followed next year at Quetta possessed a general similarity to that of Bihar in all its geological features, both being parts of the Indo-Gangetic alluvium where it meets a periphery of solid rocks

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THE ANNUAL CONFERENCE OF BRITISH GEOGRAPHICAL ASSOCIATION

(Extract from Nature)

On January third, Sir Thomas Holland delivered his presidential address to the Geographical Association on the occasion of its annual conference at the London School of Economics. Taking as his title "The Geography of Minerals", Sir Thomas gave a penetrating analysis of Economic and political effects of the unequal distribution of mineral wealth.

Until the Industrial Revolution, little interest had been taken in mineral wealth other than the precious metals, and world development was on an Agricltural basis. Political boundaries took no notice of mineral fields. The Industrial Revolution placed a new emphasis on coal and iron, and later the development of steel-making and more the recent discoveries of the uses of alloy steels, together with the expansion of the electrical trades with their great demand for non-ferrous metals such as copper and lead reoriented the political outlook on minerals. More minerals were actually produced between 1900 and 1925 than during the whole previous history of the world, and although production is

still lower in value than that of the field and forest products it is increasing rapidly, and its effect on political geography is becoming more and more evident.

The possession of, or free access to, a wide variety of minerals is now an essential to the well-being of a great nation, and the unequal distribution of resources, together with the post-war tendency to frustrate the normal or natural movement of raw materials, is at the bottom of much of the present unrest in the World. Both Germany and the Italian Empire are lacking in many of the essential minerals.

It is a striking fact of mineral geography that some seven tenths of the world's iron and steel industry is situated in the countries that border the North Atlantic Ocean. In no other area of the world do coal and iron come together in sufficient quantities ever to give rise to other great steel-producing regions like those of the Eastern United States and Western Europe. It is this industry which has so largely affected the accessary mineral industries (Manganese, chromium, nickel, cobalt, tungsten, etc.,). Between them, the United States and the British Empire own about two thirds, and control about three quarters, of the world's mineral Industries.

The need for such a wide variety of minerals has meant that the former self-sufficiency of nations in respect of mineral requirements has gone for ever. More than ever before the nations are now interdependent. Here again it is noteworthy, however, that a wide variety of resources occurs in the areas which lie around the North and South Atlantic Oceans. Thus with the British Empire and the United States on friendly terms, and the Atlantic shipping routes under their control, neither Britain nor the United States need have any fears about the supply of any mineral at present considered as vital to industry, whether peaceful or warlike. This rather one-sided position only seems to emphasize the necessity for interchange of mineral products between the nations, if civilization is not to be destroyed in the revolt of the 'have nots' against the 'haves'.

In *a symposium on India*, at the same Conference, Sir Thomas Holland contributed a short survey of India's mineral resources, dealing especially with coal and iron, manganese and chromite. Another contribution was from Lord Meston, who described in vivid terms the superimposition of British autocracy, which has converted a congeries of almost mediaeval peoples into a modern democratic State of 350 million souls, and the difficulties which rapid progress has brought. Dr. L. Dudley Stamp, in suggesting a division of India into physiographic regions, emphasized that the study of modern geography is still in its infancy in India, and that although

the universities are now taking a lead, a vast field of work awaits the geomorphologist in utilizing and correlating the mass of material available in the publications of the Geological Survey and elsewhere. In the meantime it is important that the main physical features of each of the major regions of India should be understood and regarded as an essential background to human and economic geography. Prof. H. J. Fleure finally gave a brief introdution to the study of the nature and origin of some of the Indian peoples.

Another topical item in the Conference was a lecture by Dr. Hilda Ormsby on the 'Sudeten'-lands. Dr. Ormsby also spoke on the problem of Czechoslovakia to the annual meeting of the Institute of British Geographers, which was in session during the same week. Dr. Ormsby presented a clear picture of the geographical background of the recent crisis. Before the Great War, Bohemia was an outpost of Slavdom, forming the industrial core of the Austrian Empire, and fringed with a population of Germans who had filtered across the mountains from the west during many centuries. The Treaty of Versailles allied the Czechs to the Slovaks and Ruthenians, and cut off the 'Sudeten' Germans of the northern and western fringes of the new State from their Austrian motherland. The Bohemian 'salient' of Slavdom became a violent aggravation to the new Reich after the Anschluss, thrusting a spear-head into the heart of Greater Germany. The curious nature of many parts of the 'Sudeten' frontier, which, instead of following sparsely populated, forested country, frequently cut across populous areas, was a natural incitement to the reunion of the German-speaking peoples on either side.

The 'post-Munich' frontier however, cannot undermine the essential geographical unity of Bohemia. The similarity of the industrial occupations on both sides of the highland frontier of Bohemia (the Ore Mountains, Giant Mountains and Sudetes) means that the 'Sudeten' lands are economically tributary to the interior of Bohemia rather than to Saxony, and the fact that the Czechs, for some years, had been removing industry from the 'Sudeten' regions into the heart of Bohemia, has rendered these areas poorer and more liable tc unemployment. The new Czechoslovakia, although far more homogeneously Slav than ever before, can scarcely be regarded as anything but a puppet State, held together by the power of Germany. The new German motor-road along the Moravian corridor will sever completely the western and eastern parts, of the country, and the main lines of rail communication between east and west have already been cut by the new frontiers in several places.

—*Nature*, No. 3613, January 28, 1939.

Select Contents from Journals

Quarterly Journal of the Mythic Society: January 1939.

India and Old Ceylon—By A. Srinivasan.

Indian Culture: October 1938.

The Aryan Colonies of Kishkindha and Lanka—By Diwan Bahadur K. S. Ramaswami Sastri.

Calcutta Geographical Review: September 1938.

The Physiography of Rajputana—By Dr. A. M. Heron.

The Structure of the Himalayas and of the North Indian Foreland—By D. N. Wadia.

New Asia: January 1939.

Recent Italian Explorations in Tibet—By H. E. Giuseppe Tucci.

Pan-Arabism—By Asit Mukherji.

The Geographical Journal: January 1939.

Climate, Irrigation and Early Man in the Hadramaut—By G. Caton-Thompson and E. W. Gardner.

Famine and Water Supply in Western Rajputana—By F. F. Fergusson.

Geodesy in India—A Review.

The Geographical Journal: February 1939.

The Sources of the Brahmaputra, Indus, Sutlej and Karnali—By Swami Pranavananda.

Plantation and Agriculture in Malaya, with notes on the Trade of Singapore—By A. W. King.

The Distribution of Rural Settlements.

The Geographical Journal, March 1939.

The Canadian Shield and its Geographic Effects—By E. L. Bruce.

The Fifth International Congress of Photogrammetry, Rome, 1938.

The Scottish Geographical Magazine: January 1939.

Landscape and Society—By Robert E. Dickinson.

The Growth of Inland and Seaside Resorts in England—By E. W. Gilbert.

Bracken, Heather and Mat-grass: an Ecological Triangle—By E. Wyllie Fenton.

Geography: December 1938.

The Terrain of Early Chinese Civilisation—By Percy M. Roxby.

Some Comments on the Use of Broadcasting in the Teaching of Geography—By P. C. Going.

Physical Factors affecting Localisation of the Boot and Shoe Trade in England—By C. P. Sargent.

The Geographical Magazine: January 1939.

People of the Hadhramaut, II—By Freya Stark.

Germany's Former Colonies, V. The Mariana, Caroline and Marshall Islands—By Paul Hibbert Clyde.

The Geographical Magazine: February 1939.

Yucatan and the Mayas to-day—By Helga Larsen.

Places and Products, VI. Bulgarian Rose Oil—By J. Allan Cash.

Germans in the Himalayas.

The Geographical Magazine: March 1939.

Tunisia—By Alan H. Brodrick.

The Journal of the Manchester Geographical Society: Vol. XLVIII —1937-38.

Ex-German Colonies of Africa—By Walter Fitzgerald.

Fiji: The Islands and Peoples Revisited—By Dr. J. P. Thomson.

Geographical Review: January 1939.

Changing Chungkiang: The Rebuilding of an Old Chinese City—By J. E. Spencer.

The Geographical Regions of Palestine—By D. H. Kallner and E. Rosenau.

The Bursa Region of Turkey—By Carl Louis Stotz.

Air Masses and Fronts in South America—By Preston E. James.

The Quaternary Terrace System of Southern Asia and the Age of Man—By Hellmut de Terra.

News and Notes

This issue of the Journal, which commences the 14th volume, opens with *the Presidential Address of Mr. N. Subrahmanyam,* delivered at the Geography and Geodesy Section of the Indian Science Congress at its 26th Session held at Lahore in January 1939., It presents a synthetic view of India on a geographical basis.

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An account of his impressions of the Indian Science Congress Session at Lahore with special reference to the Geography Section is published on another page from the pen of a talented visitor.

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The first meeting of the Association for the year was held on January 2, 1939 at the Meston Training College, when Mr. K. G. Grubb of the Mildew Settlement, London, a delegate to the World Missionary Conference at Tambaram, delivered an interesting and useful lecture on "*Regional Contrasts in Brazil,*" with Miss E. D. Birdseye in the chair.

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The 13th Annual Meeting of the Association was held at the Meston Training College on February 17, 1939. The 13th Annual Report for the year 1938 (appended to this number) was passed; and the results of the election of office-bearers and members of council were announced (Vide wrapper sheet). Miss E. D. Birdseye is the President of the year.

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An ordinary meeting was then held with Mr. M. Subramania Ayyar in the chair, when Mr. N. Subrahmanyam gave a talk on "*Some Impressions of the Punjab*," a summary of which is given on another page.

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A meeting of the Coimbatore Branch of the Association was held at the Students' Literary Association, Coimbatore on 7th February 1939, when Mr. S. N. Chandrasekhara Iyer (of the Agricultural College) delivered a lecture on "*The Major Crops of Coimbatore District,*" with Mr. M. S. Natesa Iyer (of the Government College) in the chair.

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Another meeting of the Coimbatore Branch was held at the Municipal High School Hall on 25th February 1939, when Sri A. V.

Kutti Krishna Menon, M.A., B.L., L.T., gave a lantern lecture on "*Impressions of Japanese Tour*", with Sri Rao Bahabur C. M. Ramachandra Chettiyar in the chair.

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A Summer School of Geography has been organised under the auspices of the Association to be conducted at the Geography Department of the Teachers' College, Saidapet from 17th April to 20th May 1939. Lodging and boarding for those that require it will be provided in the Teachers' College Hostel; and special arrangements are made to accommodate lady teachers. The course will be an intensive one; and will be longer than usual by two weeks.

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The Ninth Geographical Conference of the Association will be held at the Kellett High School on the 8th, 9th and 10th May 1939, along with the Provincial Educational Conference, when papers on various aspects of the Geography of Madras and its Environs will be read. *Prof. Rao Saheb C. S. Srinivasachari* of the Annamalai University will preside.

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Two Refresher Courses in Geography have been organised by the Deputy Inspectors of Schools, North and South Ranges of Madras City, for the benefit of teachers of Aided Elementary Schools in the two ranges at different centres; and the classes are conducted by Mr. N. Subrahmanyam.

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The Academic Council of the University of Mysore has accepted the proposal to include Geography in the Intermediate Course. It is understood that it will be actually given effect to in 1940.

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It is pleasing to note that degree courses have been recently started in Geography in the University of Calcutta, thereby coming into line with other Northern Indian Universities in this respect. Madras continues to have the degree course in the University Calendar only!

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While the diaster of the Dehra Dun Express near Hazaribagh Road in Bihar on the 12th January 1939 is officially believed to be due to sabotage—removal of rails by some unknown persons—the Special Correspondent of *the Labourt Times*, extracts from whose article appear elsewhere, strikes an original note, by tracing the

causes of the disaster to the unsettled condition of earth after the terrible recent earthquake.

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We are glad to welcome the revival of the defunct Geographical Association of Ceylon, under the name of the *Ceylon Geographical Society,* with Mr. D. N. Wadia, the Government Mineralogist, as President

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The Annual Conference of the British Geographical Association was held at the London School of Economics in the first week of January 1939 with Sir Thomas Holland as President. A summary of his Address on "*the Geography of Minerals*" and of the symposium on India is published on another page.

Reviews

Map Work. By Phyllis Dink. (Atma Ram & Sons, Lahore). Price Re. 1 As. 12.

This book is suitable for use by students preparing for the Intermediate Examination in Geography, for which map work is an essential part of the course. It covers the whole ground, as can be seen from the following list of topics dealt with—scale, representation of relief, map-reading, map-drawing from given data, distributional and weather maps, field work and projections. The treatment is simple and elementary, and nothing essential has been omitted. The exercises at the end of each chapter are just the sort required—suggestive and typical. The illustrations are choice and to the point; and the get-up neat and attractive. The book appears to be the first of its kind produced in India, which is evidence of the growing importance of geographical studies in the country.

Recent Discoveries of Fossil Algae in the Cretaceous Rocks of South India. By Prof. L. Rama Rao. (Reprint from 'Current Science,' Vol. VII, No. 5, November 1938).

Fossil algae are valuable in themselves and for dating purposes. Prof. L. Rama Rao of Central College, Bangalore and his band of co-workers have been discovering them in Trichinopoly limestones, Pondicherry limestones, and the sedimentary inter trappean beds of the Deccan Trap at Rajamundry. This reprint is a *resume* of their work.

The Trichinopoly district finds are sub-divided, and classified and their *inter se* relation shown. The Pondicherry finds open u a new field of cretaceous algae which have to be correlated wit the Trichinopoly ones. The Rajamundry finds tend to disturb th opinion that the inter-trap beds belonged to the upper cretaceou age. A palaeocene age is indicated; and the collection of nin species of *chara* there found indicate a lower tertiary age for th inter-trap beds containing them. It is a matter in which the wor palaeo-botanists who are none too many have to give their opinio Prof. Julius Pia of Vienna to whom the specimens were submitt has given his opinion. What Prof. Birbal Sahni thinks of the we shall know by the next Science Congress at Madras. Whatev the correctness of the inferences, it is a valuable summary

highly important work done by Prof. Rama Rao and others that is presented in this reprint.

L'Homme, La Route et L'Eau en Asie Sud-Occidentale. By J. Gottmann. (Reprint from Annales de Geographie : Libraire *Armand Colin, Paris*).

It has been a geographical problem to account for the disappearance of the great High-roads of South-West Asia which linked the three continents. Long stretches of desert and numerous buried cities mark their site. A Theory of Desiccation has been invoked to explain that : that formerly there was much water but that the climate has since gone dry.

Mr. Gottmann has no need of it. He brings cogent arguments to show that it was dry then as it is dry now. In all the excavated cities, archaeologists find wells. cisterns for water both private and public, and tapping of underground supplies, all which show not only that difficulties were felt in finding water enough on the surface but that the underground resources of water were the principal sources of supply. We have to-day the tunnelled channel : the *qanat* of Iran, the *Kehariz* of Iraq and the *karez* of Baluchistan. Geological evidences show even now the presence of such subterranean water sources in such places. The deserts were even then deserts ; and it was because of the value of commerce and trade in the continents that the silk-roads and incense-roads were alive with caravans, with Arab Bedouins and camels fraught with rich merchandise. The centre of gravity shifted westward from the Mediterranean to the Atlantic ; with that fell also the importance of the overland route.

There has been a re-shift of that centre Eastward upon the openiing of the Suez Canal ; and parallel to the sea-way, the old highroads are bound to revive. The railway from Berlin to Baghdad was an attempt ; the Haifa-Damascus line runs closely. The air-ways follow those old routes. The Motor Lorry, that 'true ship of the desert' is certain to revive the old routes. Already the Arab and Bedouin have taken kindly to it. They know the value of the Ford Lorry ; give it a highly prolonged life; and recognize no limit to the density of its population.

Such in outline is Mr. Gottman's thesis ; and he maintains it with a wealth of erudition and insight which should bring conviction home.

Catalogue of Coins in the Madras Government Museum (Bulletin of the Madras Government Museum) New Series—General Section, Vol. III, Part 3. By T. G. Aravamuthan. (Published by the Superintendent, Government Press). (1938). Price Rs. 1 as. 8.

There are fourteen coins in the Madras Museum, besides one imitation, which were found in treasure-troves at Kunnathur (Erode Taluq), Kelshi (in Dapoli Taluq, Ratnagiri Dt.) and in Malabar, or were acquired from private collections made probably in Madura Dt.

The venetian ducats or sequins, here described belonged to the period from 1545 to 1797 A.D. Mr. Aravamudhan tells us how they used to come in, in numbers, in the imports from abroad, being prized for the purity ; how India herself having good coinage, these gold coins came in as *specie* for barter against India's spices; muslins ; diamonds, rubies and other precious stones ; indigo ; aromatic roots ; etc. He enters into disquisitions upon Italian contacts Italian adventurers and travellers from Marco Polo to Manucci trade of the West with India ; the ancient carrying trad and Inland trade of the Arab from the Japanese Se to the Baltic Sea and Spain, accounting for Arab coin found all over ; the diversion of trade from the Mediterranea to the Atlantic with consequent loss to Venice, Italy and the Arabs and India's attracting the gold of the world, and its silver to throughout the ages with her favourable balance of trade. He h focussed references, relevant to these in the Travel Books and oth authorities; a map showing the places in the extracts would ha been a valuable appendix.

Columbum at p. 18 (last para) is no other than the Malayal name of the town Anglicised as Quilon.

What is known as *shanan kasu* prized for necklaces in Ta Nadu is no other than the broad *sequins*. A plate at the end sho the obverse and reverse of ten of the fourteen coins in the Museu

---

Settlements in the Lower Indus Basin (Sind). By Maneck Pithawalla, 1939, Karachi. Price Rs. 5.

Having made a geographical analysis of the main phys features of Sind in some of his earlier works, Prof. Pithawalla attempts a synthetic treatment of the history and progres human settlement in the region, bringing out the influence of geographical features on the settlements. In the first part of thesis, which is a reprint from the Journal of the Madras Geo

phical Association (Vol. XIII—No. 4), the influence of the climatic, geomorphological, tectonic and hydrographical changes in the region have been examined to afford the proper basis for a study of the present conditions and problems of population in the Province as well as of the work of man—dealt with in part II. The brochure is well illustrated with maps and diagrams, among which special mention may be made of the use of the *ergograph*, suggested by Dr. A. Geddes, showing the annual rhythm of human life and activities.

A Bibliography of Sind: By M. B. Pithawalla, 1939, Karachi. Price As. 4.

This is the reprint of a paper contributed to the Lahore session of the Indian Science Congress. It discusses the causes for the existence of over a score of hot springs within 100 miles of Karachi, and suggests that Government may develop at once six of them, well-known for their curative virtues, providing modern facilities of residence etc.

Greater Karachi. By M. B. Pithawalla, 1938, Karachi. Price As. 4.

This is also a reprint of another paper, read at the same session of the Indian Science Congress. After discussing the peculiar population problems of Karachi as a rapidly growing provincial capital under the influence of the Sukkur and Canal Colonies of its hinterland, the author suggests the building of satellite towns within a radius of 12 miles, with independent water supply and modern transport facilities for avoiding the present congestion and providing for future expansion.

A Bibliography of Sind. By M. B. Pithawalla, 1939, Karachi. Price As. 8.

The publication of a list of works of geographical value bearing on Sind, arranged authorwise in alphabetical order, prepared in the first instance apparently for his own guidance by the author, ought to prove useful for other workers in the same field of research.

Exercises in Modern Geography: Book VIII—*Africa.* By A. W. Coysh and D. M. Hunt. (University Tutorial Press). Price 1sh.

This is one of a series of Practical Exercise Books in Modern Geography, the earlier numbers of which have been reviewed in

back issues of this Journal. The exercises, which are suggestive and stimulating, have been carefully thought out and well-planned, calculated to encourage atlas study and the critical examination of pictorial material, of which typical examples are provided. The series can be used profitably in secondary schools, whatever may be the prescribed syllabus.

An Atlas of Indian History (Hindi, Urdu and Bengali editions). By E. W. Green. (Macmillan & Co.). 1938.

We are glad that the publishers of this very useful atlas in English have read the sign of the times aright and have brought out editions of it in three of the most widely spoken Indian languages—Hindi, Urdu and Bengali. Now that teaching the non-language subjects through the medium of the mother-tongue is the vogue, there is need for reproducing them in the other chief Indian languages also.

We repeat what we stated about the English edition that the value of this atlas is enhanced considerably by its three peculiar features—(1) of illustrating periods and not isolated stages or special events only (i.e., " representing the road and not merely the milestones "), (2) of illustrating the main geographical features that have influenced the course of Indian History, and (3) of indicating the extent and importance of India's external relations, and emphasizing the fact that India has never been an isolated country but " a link in a great chain of countries."

Bhuvivarane (Canarese). By M. N. Kamath. (School Book Co., Mangalore), 1938. Price As. 12.

This is a text-book of geography in Canarese for form IV, prepared in accordance with the revised S.S.L.C. Syllabus of the Madras Educational Department. The matter is presented in easy and simple Canarese in a lucid manner by an experienced teacher of the subject; and the book is illustrated with maps, pictures and diagrams, and printed in bold type and well got up The exercises given at the end of the book are suggestive and useful; but it is preferable that they are distributed among the several pertinent chapters, so that they can be worked out at the end of each lesson as part of its study.

Books and Journals Received

Map Work. By Phyllis Dink.

Exercises in Modern Geography: Book VIII: *Africa.* By A. W. Coysh and D. M. Hunt.

Settlements in the Lower Indus Basin; (Sind). By Maneck B. Pithawalla.

Greater Karachi. By M. B. Pithawalla.

Potential Spas of Sind. By M. B. Pithawalla.

A Bibliography of Sind. Compiled by M. B. Pithawalla.

Bhuvivarane (Canarese). By M. N. Kamath.

Regional Geography of the World (Tamil). By N. Subrahmanyam.

Recent Discoveries of Fossil Algae in the Cretaceous Rocks of South India. By L. Rama Ro.

Catalogue of Venetian Coins in the Madras Government Museum. By T. G. Aravamuthan.

Report on the Operations of the Department of Agriculture, Madras Presidency, for the year 1937-38.

Concise Survey of Agriculture in Palestine. By the Audit Union of the Workers' Agricultural Co-operative Societies, Ltd.

Atlas of Indian History (Hindi, Urdu and Bengali). By E. W. Green.

L'Homme, La Route et L'Eau en Asie Sud-Occidentale. Par J. Gottmann.

Journal of the Manchester Geographical Society: Vol. 48—1937-38.

Verzeichnis der Periodisch. Scriften der Bucherie der Gesellschaft fur Erdkunde zu Leipzig. 1938.

Kalaimagal: December 1938, January, February and March 1939.

Indian Journal of Economics: October 1938 and January 1939.

Calcutta Geographical Review: September 1938.

Indian Co-operative Review: July-September 1938.

Indian Culture: October 1938 and January 1939.

Indiana: November 30, 1938.

The Educational Review: November and December 1938, and January 1939.

Southern India Commence: December 1938, January and February 1939.

Journal of Indian History: December 1938.

The Geographical Journal: December 1938, January, February and and March 1939.

The South Indian Teacher: December 1938, January and February 1939.

The Indian Educator : December 1938, January and February 1939.
Geography : December 1938 and March 1939.
Educational India : December 1938, January, February and March 1939.
Quarterly Journal of the Mythic Society : January 1939.
Scottish Geographical Magazine : January 1939 and Index for 1938.
Geographical Review : January 1939.
Geographical Magazine : January, February and March 1939.
New Asia : *January* 1939.
The Ramakrishna Home and Schools Magazine : January 1939.
Foldrazji Kozlemenyek (Hungarian Geographical Review) : Vol. LXVI, Nos. 6-7 and 8-10. 1938.
Brahma Vidya (Adyar Library Bulletin) : February 1939.
Journal of the Annamalai University : March 1939.
Visva-Bharathi Quarterly : February-April 1939.

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THE MADRAS GEOGRAPHICAL ASSOCIATION, 1938

(1st January to 31st December).

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The Executive Committee consists of the President, the Secretary, the Asst. Secretary, the Treasurer, Mr. George Kuriyan and Miss Mary W. F. Waddington.

All communications and remittances should be addressed to—

The Secretary,
The Madras Geographical Association,
Gopalapuram, Cathedral Post, Madras.

THE THIRTEENTH ANNUAL REPORT OF THE MADRAS GEOGRAPHICAL ASSOCIATION, 1938

The Council has the honour to present the following Report for the period from January 1 to December 31, 1938.

The strength of the Association stood at 152 members at the end, and at 165 members at the commencement, of the year. The fall in the number is due chiefly to the dropping-off in Associate (*i.e.*, non-Journal) Members.

The Journal is subscribed for by 158 as against 150 in the previous year.

The State of Finances of the Association is set out by the Auditor, in his Report which is Appendix B hereto. Receipts under diverse heads are Rs. 2,519-6-1 and of this Rs. 75 is a donation from Mr. N. Subrahmanyam. The expenses have been Rs. 2,398-0-4 excluding about Rs. 250 for outstanding Bills. The accounts have been cleaned up by striking out arrears of subscription borne in the books but found irrecoverable. The previous advance of Rs. 404 by the Secretary has had to be carried forward, as the expenses were very great due to the increased expenditure incurred in improving the quality of the Journal.

The Eighth Geographical Conference was held at Mangalore, May 19 to 22, 1938. A report of the Proceedings is printed in *The Journal* (Vol. XIII, pp. 219-20). Several of the Papers, read there, have been printed in the September and December issues of that Volume. Studies in District Geography inaugurated by the Association now comprise eight districts.

Some of the most distinguished British Geographers attended the Silver Jubilee Session of the Indian Science Congress at Calcutta, in January 1938. It is very gratifying to note that they have been highly impressed with the work of this Association, in all directions, in the twelve years past. Such warm approbation of such work by such men, so pre-eminent in Geography, is a treasure and inspiration to those responsible for its activities. Three of them passed through Madras and their presence was availed of by the Association so as to have the benefit of their illuminating discourses.

Dr. Arthur Geddes of Geography Department, Edinburgh, who has been on a geographical tour in India these six months, was in Madras in September, 1938 ; and in his simple, quiet way, had given many a helpful suggestion.

Geography is winning wider and wider recognition in India, as is evident from the fact that North Indian Universities like Aligarh, Agra, Lahore, Patna and Calcutta have opened and offer Degree courses in it. It is evident also from the fact that the Indian Science Congress has made Geography into a separate Section permanently. This Association notes with pleasure that one of its members, Mr. N. Subrahmanyam, was elected to be the President of the Geography Section at its Lahore Session (January, 1939) and that its next session is to be held in Madras (January, 1940).

An Association, such as this, with its record of solid work looks forward with hope to another year of useful activities.

GOPALAPURAM,
CATHEDRAL POST,
Madras, 31st Jan. 1939

(By Order)
N. SUBRAHMANYAM,
Secretary.

APPENDIX A.

List of Meetings of the Association in 1938.

Date.	*Subject.*	*Lecturer.*	*Chairman.*
-1—38	Land Utilisation Maps for India.	Dr. L. D. Stamp.	
-1—38	Aim and Method of Teaching Geography.	Prof. C. B. Fawcett.	
-2—38	The Annual Meeting.		Mr. G. Narayanaswami Ayyar.
-2—38	Impressions of my recent World Tour.	Mrs. P. S. Sundara Raj.	Mr. T. R. Venkatrama Sastri.
-3—38	The Rivers of the Palar Basin.	B. M. Tirunaranan.	Mrs Sundara Raj.
-4-38	Summer School of Geography and Popular Lectures at Bangalore.	Vide Journal, Vol. XIII pp. 211—8.	
-5-38	Eighth Geographical Conference at Mangalore.	Vide Journal, Vol XIII pp. 219—20.	
-7—38	Trade of the Madras Port.	K. Ramamurthy.	K. C. Ramakrishnan.
-9—38	Dynamic Problems of Indian Geography.	Dr. Arthur Geddes.	Miss E. D. Birdseye,
-11-38	A Peep into Kashmir.	K. C. Veeraraghava Ayyar.	K. Narasimha Ayyar.

APPENDIX B.

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

Statement of Receipts and Disbursements for the year ending 31st December, 1938.

RECEIPTS.

		Rs.	A.	P.
OPENING BALANCES:				
Cash to be remitted	...	44	0	0
Balance with Indian Bank	...	40	3	7
Balance of Imprest A/c.	...	2	1	7
Balance of Postage A/c.	...	0	8	6
Entrance fees	...	24	0	0
SUBSCRIPTION:				
Ordinary Membership	...	927	0	0
Associate Membership	...	82	0	0
Institutions	...	550	0	0
Sale of journal, etc.	...	29	9	0
Donation from Secretary	...	75	0	0
Postal charges recovered	...	4	11	5
Summer School fees	...	825	0	0
Interest from Bank	...	2	1	8
Advances from Secretary	...	154	0	0
Total	...	2,760	3	9

DISBURSEMENTS.

		Rs.	A.	P.
Journal Expenses	...	1,357	11	6
Postage and Telegrams	...	213	2	3
Stationery	...	19	13	9
Office rent	...	180	0	9
Clerical services	...	2	8	0
Peon's services	...	60	0	0
Honorarium to auditor	...	20	0	0
Conveyance, cooly, etc.	...	11	6	0
Telephone, typing, bank-commission & sundries	..	31	0	6
Cycle repairs	...	6	8	0
Advance repaid to Secretary	...	150	0	0
Books and Maps, etc.	...	19	8	0
Donation to Central Ed. Week Committee	...	5	0	0
Refund of Summer School fees	...	14	0	0
Teachers' T.A. & D.A. re:				
Summer School	...	440	8	0
Other Summer School Expenses	...	16	14	0
CLOSING BALANCES:				
Balance at Bank	...	179	13	8
Balance of imprest	...	19	7	7
Balance of Postage	...	12	14	6
Total	...	2,760	3	9

Income and Expenditure Account for the year ending 31st December, 1938.

EXPENDITURE.

		Rs.	A.	P.
To Journal Expenses	...	1,407	11	6
,, Postage and telegrams	...	213	2	3
,, Stationery	...	19	13	9
,, Office rent	...	180	0	0
,, Clerical services	...	2	8	0
,, Peon's services	...	60	0	0
,, Honorarium to auditor	...	20	0	0
,, Conveyance, packing, cooly, etc.	...	11	6	0
,, Telephone, typing, bank commission, meeting expenses and sundries	...	31	0	6
,, Cycle repairs	...	6	8	0
,, Donation to central education week committee	...	5	0	0
,, Refund of Summer School fees	...	14	0	0
,, Teachers' T. A. & D. A. re: Summer School	...	440	8	0
,, Other Summer School Expenses	...	16	14	0
,, Life Membership Subscription written off	...	75	0	0
Total	...	2,503	8	0

INCOME.

		Rs.	A.	P.
By Subscription received and outstanding:				
Ordinary Membership.		738	0	0
Associate Membership.		152	0	0
Institutions	...	151	11	0
,, Entrance fees	...	24	0	0
,, Sale of Journal, etc.	...	29	9	0
,, Donation from Secretary	...	75	0	0
,, Postal charges recovered	...	4	11	5
,, Summer School fees	...	825	0	0
,, *Interest from Bank*	...	2	1	8
,, *Deficit (to Balance Sheet)*	...	501	6	11
Total	...	2,503	8	0

THE MADRAS GEOGRAPHICAL ASSOCIATION, MADRAS.

Balance Sheet as at 31st December, 1938.

Liabilities.	Rs. A. P.	Rs. A. P.	Rs. A. P.
LIABILITIES FOR :			
Advance subscription		21 0 0	
Journal Expenses (estimated) ...		250 0 0	
Advance by Secretary		404 0 0	
			675 0 0
FUNDS OF THE ASSOCIATION :			
Capital Fund ...		300 0 0	
Research Fund ...		6 0 0	
Association Fund			
Balance as per last B. Sheet...	520 12 2		
Less Deficit since ...	501 6 11		
		19 5 3	
			325 5 3
		Total ...	1,000 5 3

Assets.	Rs. A. P.	Rs. A. P.
FURNITURE (AT COST) ...		120 13 0
Cycle (at cost) ...		45 0 0
Books, maps and Equipment (at cost) ...	256 12 6	
Add additions in the year ...	19 8 0	
		276 4 6
SUBSCRIPTIONS OUTSTANDING :		
Ordinary Membership ...	145 0 0	
Associate Membership ...	70 0 0	
Institutions ...	131 0 0	
		346 0 0
CASH & OTHER BALANCES :		
Balance with Indian Bank Ltd. ...	179 13 8	
Balance of Imprest Account ...	19 7 7	
Balance of Postage Account ...	12 14 6	
		212 3 9
	Total ...	1,000 5 3

N. SUBRAHMANYAM, *Secretary.*

T. R. V. SASTRI, *President.*

K. SRINIVASARAGHAVAN, *Treasurer.*

Auditor's Report.—Checked the accounts and prepared the above statements which are in my opinion correct according to the books etc., maintained and produced before me, and the explanations given in this connection. Depreciation may be written off on cycle and furniture, and inventory (annual) of books, maps, etc., may be taken. Closing dues of subscription are made out after ignoring dues considered irrecoverable.

G. L. NARASIMHAM,

Madras, 10th January, 1939. *Registered Accountant, Auditor.*

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Growth of Modern Coimbatore *

By

Rao Bahadur C. M. Ramachandra Chettiar, B.A., B.L., F.R.G.S.

I. INTRODUCTION

The city of Coimbatore has grown within a short period of twenty-five years, by leaps and bounds, into a famous industrial city.

It is now one of the largest towns in the Presidency regarding opulation, extent, industry, commerce, wealth and public activities. t has one of the most equable climates in the Presidency with a ery mild hot weather and a dry atmosphere. It has an elevation f 1426 feet above the mean sea level and is situated within a short istance of the Hill stations on the Nilgiris. It is also located on he borders of a large cotton-growing area. These facts hold the ecret of its recent rapid growth. They have no doubt influenced he establishment of a large number of industrial concerns and of ducational institutions in and about the town. These establish-ents have led to the filling up of open fields between a number scattered hamlets round about the old town, a big city thus rming itself out of the cluster of villages.

II. A SKETCH OF ITS GROWTH

(a) *Origin and early history.* The tract of territory between upper part of the river Cauvery and the ranges of hills known the Anamalais and the Nilgiris, has a distinct geographical

* Being the substance of a paper read before the 26th session of the Indian ience Congress at Lahore, January 1939.

feature and has been known as Kongu Nadu from ancient days. It was full of forests in olden times; and people slowly began to occupy at first the tracts along the river courses. The forests were generally inhabited by aboriginal tribes like Irulas. The Boluvampatty valley from which Noyyal river rises and flows eastwards was a thick forest-clad tract about a thousand years ago. On the northern bank of that river in a forest village formed of a few huts, an Irula chief, Kovan, lived. About the beginning of ninth century, a Sivachariya with the help of his friend, the Chera chief, travelled through these parts—both being highly enthusiastic for religion and civilization: the jungle was cut down, three temples were built and a small fort and a petta constructed. In memory of the Irula chief, the place was known as Kovanputhur. The ancient manuscript which records this legend of the town mentions also that the place was colonised by a number of families from the East.

The town grew very slowly and we find according to the inscriptions of the 13th century found at Perur and Komaralingam that it was merely a hamlet in Perur Nadu in that century, that it was also known as Vira Kerala after a victor of that name.

In the subsequent five centuries we hear little of its existence or its growth. In the 18th century, we find its name mentioned in the Mysore wars. Hyder and Tippu occupied the town off and on; and one building, now hostel for girls of the Secondary School, is said to have been the palace of the governors from Mysore and is pointed out to be that which Tippu occupied when he visited the town. The town was besieged thrice in the Mysore-British wars in the years 1768, 1783, and 1790 and was finally occupied by the British in 1799 A.D.

(b) *Under the British.* Even after British occupation, the town did not become capital of the district. Buchanan who visited the place in 1800 A.D. described it as a small town with a population of 15,000. It had only 2,000 houses. It became the headquarters of a district in 1805 A.D. when the two districts with headquarters at Bhavani and Dharapuram were amalgamated into the single district of Coimbatore. The town had the lay-out of the usual gridiron or rectangular pattern, like other South Indian towns. The growth after the British advent was rather slow, irregular and unregulated. A few popular collectors such as Thomas, Sullivan and Wedderburn evinced interest in the formation of extensions and their names have been perpetuated in streets named after them.

On 20—11—1866, Coimbatore was constituted a municipality consisting of eleven commissioners besides the District Magistrate

and Executive Engineer, the former being the President. Eighteen years later, the strength of the Council was increased to twenty, of whom fifteen were elected and the rest nominated. In 1908 it was further increased to 24 and in 1920 to 32. The privilege of electing its own Chairman was conferred on the Council in 1885.

(c) *Plague and Betterments.* In 1903 plague broke out in the town, which was completely evacuated and the pest was put down temporarily. In 1909, it recurred and persisted for several years. The authorities had to take drastic steps for the mitigation of insanitation and congestion and for the formation of well-laid-out town-extensions. The period of town-extension schemes lasted from 1912 to 1929. Altogether, nine extensions by the Municipality and three extensions by private enterprise were started and completed, during the period. These schemes gave a fillip to the growth of the town; and the adjoining outlying portions of the villages of Krishnarayapuram, Souripalayam, Puliyakulam and Ramanathapuram were added to the town.

The area of the town which was 4·2 square miles in 1866 rose to 7·5 square miles in 1930. The municipal limits have been further extended as far as Sanganurpallam in recent years and the area increased to 9 square miles in 1936 and it has again further gone up to 12 square miles at present.

III. A STUDY OF THE GROWTH

We shall now consider in more detail the growth of the town and its causes.

(a) *Population and density.* As stated above the population of the town in 1800 was merely 15,000. In 1866 it was 24,241; in 1921, it rose to 65,788; and to 95,198, in 1931. It is now believed to be nearly a lakh and twenty-five thousands. The town is now divided into twenty wards.

The densest portions of the town are round about the four car streets of the old town through which the main bazaar streets run. In fact, in every other South Indian town, such portion has formed the nucleus of further growth. The population has increased by 44 per cent between 1921 and 1931 and since then it has been increasing more rapidly.

(b) *Increase in number of houses.* In 1800, the number of houses was merely 2,000. Later on, they increased to 7,081 in 1891 and to 9,283 in 1915 and to 13,742 in 1936. The increase shows rapid growth. The numerous extensions both public and private are responsible for this increase. Naturally the houses in the centre or the

nucleus of the town are smaller and more congested than those which are in the extensions where every house is compelled to be constructed with an open space surrounding it. The property tax which is levied upon the houses and other immovable properties shows this increase in the growth. In 1920-1921 the property tax was Rs. 56,884; in 1924-25, Rs. 96,672; in 1930-31, it was Rs. 1,06,423; and in 1936-37, it was Rs. 2,82,785.

(c) *Taxation.* Statistics regarding the taxes collected from various sources by the municipality from 1920 till 1937 show also the rapid growth. The various items of the taxation are property tax, water and drainage tax, private scavenging tax, professional and companies tax, entertainments tax, tax on carriages and animals and tax on carts. Among the above-said taxes, water and drainage tax was started in 1925-26 and shows very rapid increase. This is due to the introduction of Siruvani water supply. Water tax was Rs. 36,875 in 1925; it became Rs. 1,49,170 in 1932-33. Entertainment tax was started in 1928-29 with the establishment of cinemas and yielded an income of Rs. 945 in that year. It rose to Rs. 7,388 in 1932-33. Tax on vehicles rose from Rs 14,813 in 1921-22 to Rs. 45,885 in 1930-31. These figures also show the great acceleration in the growth of the town.

The cost of collection rose from Rs. 8,704 in 1920-21 to Rs. 15,395 in 1932-33. The net revenue for the municipality was Rs. 79,631 in 1920-21; Rs. 1,60,342 in 1926-27; Rs. 3,29,767 in 1932-33 and Rs. 4,08,955 in 1936-37.

(d) *Industries.* The main industries in the town are of two kinds, old and modern.

Among the old industries, hand-loom weaving is the prominent one. About 3,000 families live by it. During war time, they were very prosperous; but after the world depression, their condition has become very miserable. Among the new industries coffee-and-tea-curing came in the beginning. They are in the hands of foreigners. Tanning is another industry which employs a good number of hands and is in the hands of Indians. But it is dependent on vagaries of the foreign market.

Cement industry has been recently inaugurated at Madukkarai with a huge plant and capital drawn from Bombay.

More than all these stands the textile mill industry. Its growth is recent but rapid. Spinning is common to all mills and weaving is carried on in a few of them. The number of mills within the old municipal limits is only six but the entire number of them is situated within a radius of six miles from the town. The

incidence of taxation on professional companies gives an insight into the growth of industries. In 1920-21 the taxation was Rs. 12,255; in 1925-26 Rs. 30,226; and in 1931-32 Rs. 36,213.

(e) *Education.* The educational institutions in the town and the surroundings are another indication of the growth of the town. Elementary education is imparted by the municipal, missionary, private committee and teacher-manager schools. The council provides at present free and compulsory scheme of education. Out of 52 schools with 11,808 pupils, the municipality runs 18 schools with 5,205 pupils. There is a weaving school attached to the elementary schools and also a deaf-and-dumb school run by the council. The amount of money spent on elementary education by the council was Rs. 56,197, the cost per pupil being Rs. 10-12-9 in a year.

For secondary education, there are nine institutions of which two are middle schools. Out of 2,863 pupils in all the secondary schools, 956 only read in municipal schools. The total cost for the municipality is Rs. 37,201. There is a Government College which works up to the Intermediate standard.

There are a few public libraries in the town, besides a number of associations for various social and cultural objects.

In addition, there are the Agricultural College and the Forest College which virtually constitute two independent colonies adjoining the city. (The Forest College is now closed down.) Industrial educational institutions there are like the St. Joseph's and P. S. G.'s. Training schools for men and women, Police Training School, private schools of commerce, convents and orphanages attract a large number of people from outside.

(f) *Town extensions.* It has been mentioned that there were several extensions, both public and private, within the municipality. They began with the suppression of the insanitation and congestion for eradicating plague from the town. The rapid growth in industries and the inflow of village population in the shape of mill-hands gave the fillip to these extensions. As new extensions began, the town limits had to be expanded. Taking advantage of the Town Planning Act, several private individuals owning vacant plots have planned housing schemes with the permission of the council. Recently, a large plot of ground between the town area and the Sanganurpallam intended by the Tata Company, Ltd., for the installation of a textile mill, has been converted into a housing scheme with the result that a huge profit is being made by the company. Before long, the neighbouring industrial villages of Peelamedu, Singanellur and Podanur will have to be included within the city

limits for these have become not only suburban areas but urban also. The growth of the town tends towards north and east. On the south and west, irrigation tanks and wet fields prevent extension of habitations.

(g) *Textile mills and mill hands.* The first mill in the town was started in 1888 as a limited concern. It was later on taken up by a European and has again come back to Indian management. The second mill was started by a Nattukkottai banker and is still yielding good profit. Then after the coming of water supply and electricity, in recent years, mills have been started in large numbers. Within a radius of six miles from the town, twenty-one mills have come into existence with 383,933 number of spindles and 1,260 looms. The number of mill-hands working in them are 21,526. Besides these, there are six other mills in the district with 72,744 spindles and 126 looms and 4,265 mill-hands. As already pointed out, this sudden up-rise in the mill industry has brought in a huge cooly population from the neighbouring villages. Adequate housing schemes have not been contemplated at all; and as a result of it, large slums have sprung up in and about the mill zones. By 1938, there have sprung up 26 mills in Coimbatore and 8 in the District, five of which have not yet commenced working.

IV. CAUSES FOR THE GROWTH

Regional factors, economic advantages and modern facilities have contributed to the phenomenally rapid growth of Coimbatore.

(a) *Regional Factors*—(i) *Physical features.* The town of Coimbatore is situated on the Noyyal river at the mouth of the Boluvampatti valley at a height of 1,486 feet above sea-level. The valley itself is much of a flat plain, surrounded by high hills in a semi-circle. There is a natural slope from the north-west to the south-east, of about 100 feet. So, there is a natural drainage of waste-water towards the tanks on the south of the town. This slope is taken advantage of in the water-scheme, which locates the supply reservoir at the north-western corner of the town, viz., north of the Forest College. North and east of the town are bounded by dry lands, while the south and west are bounded by irrigation tanks watered by the floods of the Noyyal and the wet fields. There is a belt of cocoanut groves along the Noyyal river which runs to within a few furlongs from the town. Irrigation tanks are about half a dozen and are dry for nearly six months. The portion of the town towards the south which is on the border of the wet fields is low and some parts are insanitary. During infections, invariably this portion of the town was the first to be affected. The north and east

of the town are higher in level and are surrounded, as already said, by dry fields. The big town extensions have been formed in these tracts only. The result is that these tracts stand better off in the matter of health. Surrounding the town, there are a number of hamlets. From the town to the hills on the north-west the lands are dry but fertile in soil. This matter has been taken into consideration in the location of the Agricultural and Forest Colleges. On the north and east the land is a plain with black cotton soil to a considerable extent.

(*ii*) *Seasonal changes*: The town is noted for its dry atmosphere. The mean temperature for the past 25 years is 79.6°F. The hottest months are April and May with mean temperatures of 85·5°F and 84·2°F respectively. January and December are the coldest months with a mean temperature of 75°F. The prevailing winds are healthy except in the months of June and July, when the winds are somewhat fierce with a mean velocity of 6½ miles per hour: and the humidity of the air is generally high. The average percentage at 8 A.M. is 80 or more in all months except March and April. The average rainfall is only 22 inches per year. Hence the town is always dry and its moderate mean temperature renders it at once healthy and pleasant. The town is protected from the heavy rainfall and winds on the Malabar side, by the range of hills which encircle the valley about a few miles from the town. The Palghat gap which opens towards Kinathukkadavu is six miles away and does not affect the weather of the town to any extent. During the monsoons, heavy clouds over-hang the hills, but the town is not affected by any downpour.

(*iii*) *Natural advantages*. The strip of land along the Noyyal river is always full of green verdure with belts of cocoanut groves and rice flats. The plains towards the north and east produce dry crops and cotton. The low hills towards the south give considerable quantity of hard granite useful for house construction, and metal for the road. The red soil along the Sanganurpallam is useful for brick manufacture. On the whole, we find that the surroundings of Coimbatore are blessed with neither too much of fertility nor too little of it.

(b) *Economic—(i) Natural vegetation*: There are no forests near by; and no hills within ten miles of the town. But in about 15 to 20 miles there are the Western Ghats which abound in minor forest produce and fuel. The town is supplied with enough fuel by the jungles on these hills and by the coups of

Valayar in the Palghat gap. The minor produce of the Forest Department includes wax, honey, gall-nuts, bark, resins etc. Wild animals such as elephants and boars do damage to the neighbouring lands near the hills; but the town and its surroundings are not affected by them.

(ii) Cultivation: As already remarked, the fertile belt along the Noyyal basin produces enough crops for consumption in the town. Very little export is possible. On the other hand, food-stuffs have to be imported into the town to a certain extent.

Paddy for man and hay for cattle come in large quantities from Malabar. Millets and cereals come from the dry lands towards the west.

The black soil towards the north and the east produces fine cotton which used to be exported to other places formerly. Now, taking advantage of the vast cotton belt in the taluks of Coimbatore, Palladam and Udamalpet, a number of textile mills have been started which take up most of the produce. It is curious to note in this connection that the Telugu Kamma has taken to the black soil and has become mill-owner; and converts cotton into yarn. Cultivation of cotton has improved of late to a considerable extent and the following figures give an idea of the extent of the produce:—In 1853, there were 152,000 acres under cotton; in 1882, the acres were 241,000; in 1926; the acreage rose to 282,614 and in 1929 it went up to 363,975.

(c) *Modern facilities*—*(i) Communications*: Coimbatore town is a big nodal centre. Through the town, the trunk road from Madras to Malabar passes. It branches from Coimbatore to the Nilgiris. Another trunk road passes from Coimbatore to Trichy and to the eastern districts and a third from Coimbatore to Mysore via Satyamangalam. Yet another road goes south to Pollachi on the way to Palni. There are several other minor roads. All these make the town a big nodal centre from which various roads radiate, thereby rendering them useful for trade. The town itself had only 27 miles and 1 furlong of road in 1866, which increased to 35 miles and one furlong in 1916 and further rose to 52 miles and three furlongs in 1930. The mileage was 82 miles 6 furlongs, in 1937.

The municipal council keeps all the main roads tarred with the result that the dust problem is under control to a certain extent. In 1936-37, it spent Rs. 38,920 for the maintenance of roads.

The railway facilities of the town are very poor for a first-class city. The receipts by way of collections for passenger and goods-traffic are second to none in the broad guage line of the S.I.Ry. The town station was neglected till now as it was merely a side-station on the branch line between Podanur and Mettupalayam. Only recently, railway authorities have taken up the reconstruction of the station to suit modern needs. According to the scheme which is now in the course of construction, Coimbatore will become a junction of S.I.Ry. joining Madras, Mettupalayam, Pollachi and Calicut. Only recently a sub-station has been opened. known as "North Coimbatore."

Coimbatore is very poor in inter and suburban traffic conveniences. The ill-equipped and rickety jutkas are the chief public vehicles. If tram is uneconomical in Coimbatore, a system of motor buses plying for hire would relieve considerably the town-congestion and would be a boon to the people. But the local municipal council does not support such a scheme. It is fortunate that the town is connected with all the neighbouring taluk centres in the district by a regular system of motor traffic run by joint stock concerns.

(*ii*) *Water supply*: As already said, Coimbatore is bounded by a number of tanks which are supplied with flood water through channels from the small river Noyyal. The collection of water scarcely stands for more than six months in the year. For some years like the present one, the tanks are dry throughout the year due to failure of rains. The water is used for wet cultivation.

Drinking water used to be got from wells dug in each house. There were a few public wells also which had to be filled up for fear of drownings. A scheme for a perennial water supply was considered by the council and the government, even from 1889. After a number of snubbings by various engineers the Siruvani scheme was finally formulated in 1920 at an estimated cost of 38.68 lakhs. The scheme was "to construct a dam across the Siruvani river in the Muthukulam valley so as to divert the flow through a tunnel cut in the water-shed ridge into the Anayar river where it will again be diverted by an off-take masonry dam to a settling tank from where it will flow along an 18 inch gravitation main 20 miles long into the service reservoir near the Forest College for distribution therefrom to the town. The scheme provides a supply of 20 gallons a day per head on a population of 1,00,000 and 5,40,000 gallons a day for industrial purposes." Siruvani reservoir is an ideal place for picnic. The tunnel has been cut

through a rock about a mile in length. Siruvani water is said to be the best in South India for purity and no city in India could boast of more profuse and better water-supply.

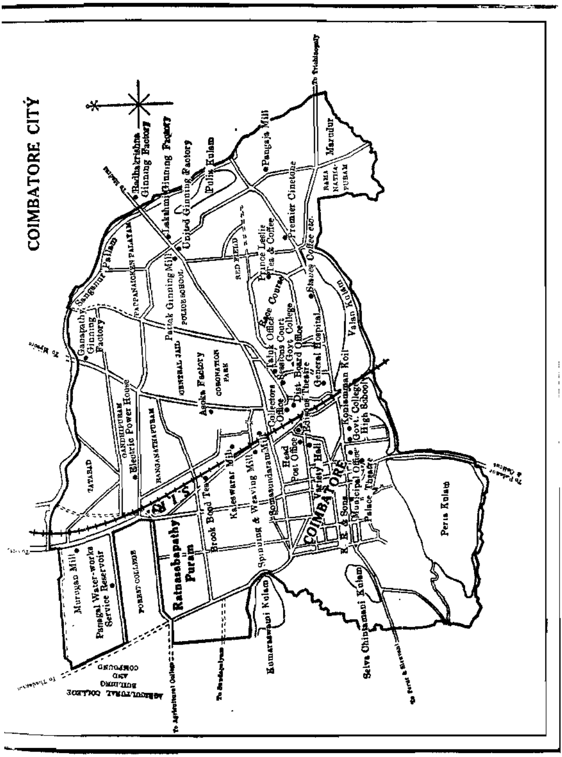
(*iii*) *Drainage*: The council has adopted an underground drainage scheme as well and has already begun to work it out. With water-supply and drainage schemes, the major civic amenities of the town are provided for satisfactorily.

(*iv*) *Electric supply*: As early as 1930, a private cinema proprietor obtained a licence for electric supply to a portion of the town. It went on for a few years when the Pykara scheme was launched by the Government. Coimbatore has the advantage of being the nearest station from the foot of the Nilgiri hills on which the Pykara waters have been harnessed for the production of electric current. Hence, Coimbatore gets the first supply. There is a huge electric distribution centre constructed at Coimbatore for sending the current to various provincial centres west, south, and east. Even in the first year, Pykara supply was availed of by the town. The council is making large profits out of its distribution scheme. Coimbatore is well lit with 2,366 lights of which 591 are of high power. Not only the major mills of the town but also minor industries such as flour mills and oil mills are worked by electric supply. Irrigation wells also are worked by electricity.

(*v*) *Aids*: Several other facilities have aided the growth of the town. It was rather a fortunate circumstance that with the growth of industry and trade, various institutions which supply financial help have come into existence.

(1) *Growth of local Banking system*: Even from the beginning of this century the merchants of this town took advantage of the provisions of the Companies Act in floating local banking concerns known locally as Nidhis. Shares were collected from individuals and a board of directors was formed. The Secretary as the executive officer would do the business. In the course of 25 years, about 50 such Nidhis were started and supplied enough funds to keep trade flourishing. With high rates in interest, the Nidhis were able to declare dividends from 12 to 18%. But of late, owing to mismanagement and the compulsory reduction of interest due to legislation, the Nidhis have begun to fail.

(2) *Nagarathar and Multanis*: Side by side with the local Nidhis, Nattukottai Chettys started their money-lending business. In the beginning, they flourished considerably with their 36% penal interest. With the growth of local banking, Chettys began


COIMBATORE CITY
Radhakrishna Ginning Factory
Lakshmi Ginning Factory
United Ginning Factory
Pulis Kulam
Pangaja Mill
Marudur
Premier Cinetone
Prince Leslie Tea & Coffee
RED FIELD
Race Course
Stanes Coffee etc.
Valan Kulam
Pattuk Ginning Mill
POLICE SCHOOL
PAPPANAICKEN PALAYAM
Sanganur Pallam
Ganapathy Ginning Factory
CENTRAL JAIL
CORONATION PARK
Asoka Factory
Taluk Office
Sessions Court
Govt. College
Dist. Board Office
General Hospital
Edisons Theatre
Collectors Office
Konisamman Koil
Govt. College High School
GANDHIPURAM
Electric Power House
RANGANATHAPURAM
TATABAD
S. I. R.
Somasundaram Mill
Head Post Office
Variety Hall
COIMBATORE
Municipal Office
Palace Theatre
K. K. & Sons
Peria Kulam
Kaleswarar Mill
Spinning & Weaving Mill
Brook Bond Tea
Ratnasabapathy Puram
Murugan Mill
Panegal Water-works Service Reservoir
FOREST COLLEGE
AGRICULTURAL COLLEGE AND BUILDING COMPOUND
Kumaraswami Kulam
Selva Chintamani Kulam
To Mysore
To Trichinopoly
To Palghat

to decline in influence. But suddenly an inflow of Multanis from Sind came into the town. With their Hundi system of 87 days' sight they roped in each and every trader. In course of time, even mill-owners could not resist their temptation. Now the entire trade and mill industry is in their clutches. They can make or mar the financial position at any moment.

(3) *Outside and foreign Banking*: The Madras Bank which became later on the Imperial Bank, opened its branch rather early in the century to meet the local as well as the Government demands. After the mill boom, outside financial concerns poured in. The Central Bank of India and P & O Corporation are two such important ones. The west coast concerns which exercised once a strong influence on the trade of the town are dwindling down, being affected by the Travancore National and Quilon Bank crash. These outside concerns are backing up the mill industry to a considerable extent. It is a pitiable sight to see the big mill-owners dancing attendance daily before the foreign banks and the Multanis for financial help.

(4) *Indigenous money-lenders*: Besides the above-said financiers, there are a number of indigenous money-lenders who live upon the interest which they get from their customers. Textile merchants, tanners, petty contractors, grocers and shop-keepers have of necessity to borrow from local money-lenders and have to pay in return a large portion of their profits by way of interest. Artisans, weavers and petty-workers cannot escape from the cluches of small money-lenders who exact high rates of interest. Even the hard Kabulis have come and batten on poor people like mill-hands and railway coolies and clerks, who cannot resist their tentacles.

(*vi*) *Capital side.* As already pointed out, there are twenty mills in and out of Combatore besides the one newly started. The mills are floated by a few enterprising people who constitute themselves as managing agents. For floating a mill and for working it out successfully, the managing agent reserves for himself a certain percentage of commission on the work done. With that assured income, he canvasses for share capital. The shareholders are proprietors of the mill only in name. They are provided with a percentage of the dividend declared each year and they are generally satisfied if a particular percentage of dividend is paid and care nothing to know about the inner working or the management of the mill. So for all practical purposes, the managing agent is the owner of the mill. He has to purchase yarn, provide money for

the running of the mill even by borrowing, earn profits and declare a satisfactory dividend. The tact and skill in the management give credit and fame to the mill. The share-holder supplies the capital and the bankers, the running expenditure. Sometimes, the authorised capital is not fully subscribed and it is kept so purposely in order to declare a large dividend. The management sees that it gets the rest of the recurring expenditure by way of borrowings. Thus, in Coimbatore, the proportion of share capital to block capital is larger than that in the Bombay Presidency. In eight typical mills of Coimbatore the block capital for 1936 was 104·2 lakhs while the paid-up share capital was only 64·34 lakhs. The latter is nearly 61·5% of the former. In Bombay it is 38% Ahmedabad 24% ; and Sholapur 13%. Coimbatore has successfully manifested this popular aspect of business.

The profits earned by the mills till now have been considerable and they have been able to declare a good dividend throughout.

The growth in mill industry is illustrated by the following figures which give the number of mills working in each year :—

Year.	*No. of mills.*	*Year.*	*No. of mills.*
1888	.. 2	1923	.. 6
1906	.. 3	1932	.. 8
1910	.. 4	1937	.. 20
1922	.. 5		

The magnitude of the industry may be judged by the number of spindles it employs, which was 352, 040 in 1937.

The following comparative statement showing the development of cotton textile industry in Coimbatore area with other centres and with the whole of India is interesting :—

Centres.	Number of mills.		Total number of spindles installed.		Total number of looms installed.		Total numb of hands employed p day on th average (da Shift) only	
	1932.	1937.	1932.	1937.	1932.	1937.	1932.	193'
oimbatore.	8	20	177,408	352,040	989	1,260	6,793	14,2
adras Presidency.	26	47	820,870	1,150,886	5,233	6,169	34,753	49,1
ombay Presidency.	220	210	6,443,519	6,100,211	141,241	141,471	256,200	243,4
ll India.	340	370	9,506,083	9,730,798	197,810	403,226	403,226	417,2

(*vii*) *Labour Side*: Now let us consider the labour side of the mill industry. From the statement of figures given in the table it would be seen that in 20 mills 3,52,040 spindles have been installed together with 1,260 looms. The number of mill-hands employed per day is 14, 228 on an average. The mill hands are generally drawn from the working classes, who are poor. In the earlier days most of the mill-hands were recruited from the town. The hereditary weavers never cared to join the mills. Various causes kept them back from becoming a mill hand. The wages of the mill are generally lower than their earnings. A weaver at home is a freer individual than a millhand. He works in his home as he pleases under a cool shade. On the other hand the mill-hand has to work in hot atmosphere filled up with cotton dust and particles. Hence a hand-loom weaver would never like to become a sickly mill-hand. As mills grew in number outside cheap labour was requisitioned. Hence labourers from the neighbouring villages came flocking to the town. The mill-owner also tried to locate his mills where cheap village labour was available. Hence the larger percentage among the mill-hands in the figure 14,228 consists of village labourers. An ordinary hand-loom weaver would earn about Rs. 15 per month whereas a mill-hand is available for a sum ranging from Rs. 8 to 11. Round about Coimbatore within a radius of six miles there are a number of villages which supply cheap labour. The agricultural labourer's wages are far less than the mill-wages. Hence, a number of agriculturists have left and are leaving their hereditary profession of agriculture in order to become a mill labourer. Every day we can see a numbe of youths going about the town for the purpose of getting admis sion to the mill.

The new recruit from the village side may not know in th beginning how to handle the machinery. But in course of time he learns the work which he has to do. In this way an unskille labourer becomes a skilled one. The wages for a skilled laboure is far below in Coimbatore than in some other parts of India or th world. 'Skilled' labour is thus obtained without much educatio without much trouble or energy or equipment.

As already said, wages are cheap in the village side. Mi owners vied with each other for getting plots of ground for the mills as near the villages as possible so that they might get chea labour. The wages of a village mill-hand will normally be tw thirds of that of an outside skilled labourer.

The cost of living in the village is very small. Hence t village worker who was living on a comparatively small amount

money prefers employment in a mill where he could get better wages and enjoyment. The village mill-hand acquires in course of time the habits of the town-labourer and begins to live a costlier life. Hence the cost of living even among the village mill-hands is already on the increase and is certainly far more than that of an ordinary villager, who sweats for his bread under hardest conditions.

The villager who emigrates towards any sub-urban mill area tries to erect a thatched shed and a roof for himself and his family and lives a hard life under insanitary conditions. This question gives rise to a proper-housing problem. The public bodies or the mill owners Associations could have started a suitable housing scheme under co-operative lines. If this housing problem is worked out on humanistic lines thinking it to be an inevitable one, then there would not be any difficulty in having a comprehensive scheme of housing problem for this ever-growing industrial city.

Education among the mill-hands is very poor and the ignorant mill-hand is always under the thumb of a profitteer or a charlatan. Proper educational facilities should be given to the labourer to make him be a man instead of a toiling animal and welfare schemes should be started for his improvement.

(viii) Stability of Industry : One risk of too rapid industrialisation is the manipulation of shares, dividends, and debentures; and a train of abuses by Company promoters who prey upon a panicky and gullible public. Of these bitter experiences, Coimbatore has had its share, though not as yet a very large share.

On the side of the labourer, stability is essential. The labourer is entitled to good treatment from the capitalist, which alone will ensure sound and honest work. The labourer must be treated as a human being and all facilities to keep him so should be given. Social work and welfare scheme should be started for the labourer and the labourer must be made to feel that he is a member of the industrial family. In such a case strikes may not occur. A number of strikes has taken place in recent years with the result that the management has lost a good lot; and the labourers, deluded and misled, have lost no less. A machinery to prevent industrial war and promote better relations between labour and capital is a crying need of the hour.

The Future. Owing to the plague, from 1903 to 1918, congested blocks were opened up and open spaces for recreation were set apart. Extensions with garden houses were started at proper centres. Even private individuals have taken up such

schemes. Sanitation has improved and health ensured. Fresh water and drainage schemes are real and invaluable boons to the town. Building material is available in the neighbourhood and construction of houses has begun in right earnest. People who do not own money get loans from building societies and then complete their constructions. The aid which co-operative department gives in this line is considerable. Roads have become better.

With such facilities which the science of town planning affords, the municipal council has played a prominent part in the growth of the town and in its local self-government. The principles of town-planning have been observed to a considerable extent.

But that is not all. Factories and Mills are springing up as fast as enterpreneurs can secure money enough to start them, with scant regard to the primary needs of sanitation or housing of mill-hands. There is no reason why provision for these last shoulc not be made as obligatory on them as any other provision. Witl zeal for public spirit and led by larger vision of Greater Coimba tore, the Municipal Council should obtain powers to rope in al mills and make licence conditional upon such provision. Only s can Coimbatore avoid the slums and chawls that are so heart-renc ing in the industrial cities of the past.

* The Major Cultivated Crops of the Coimbatore District

By

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Coimbatore is a purely inland district in the Southern part of the peninsula having for its boundaries the lofty Western Ghats on the North-West, West and South (of which the Nilgiris or the picturesque blue mountains lie on the North-West and the Anamalais on the South, leaving, however, a gap or pass to the West-coast known as the Palghat Gap " the importance of which from a climatic and commercial point of view can hardly be overestimated ") and the river Cauvery which flows all along the North of the District and for a great part on the East. The whole country is an undulating one with taluqs like Erode, Bhavani, Gobichettipalayam, with an average elevation of 900 ft. above sea level while those like Palladam, Pollachi, Udamalpet, Coimbatore etc., far higher, sometimes the elevation being as much as 1,400 ft. or more above sea level. Besides the Cauvery, which flows only on the borders of the district and is therefore of not much value, there are 3 more rivers which flow through the district, namely, the Bhavani, Amaravathi, and Noyyal. The Bhavani and Amaravathi are perennial rivers, the former having a course of 105 and the latter of 115 miles within the district. The Noyyal bisects the district and though it has a course of 108 miles is not of much value being almost a jungle stream.

The average rainfall for the district is rather poor being only about 25". The fall is heaviest in the North and extreme South. The high Western Ghats almost cut away the district from the influence of the South-west Monsoon while the country is far too inland to have the full benefit of the North-east Monsoon. The following table taken from the statistical atlas of the Madras Presidency by Rao Bahadur D. Ananda Rao Garu, the ex-Director of Agriculture, revised upto 1930-31 shows the average distribution of rainfall in the several parts of the district at different periods of the year :—

* A lecture delivered before the Madras Geographical Association, Coimbatore Branch, on February 7th 1939.

Portion of the district.	Taluqs.	Dry weather (Jan. to Mar.)	Hot weather (April to May)	S.W. Monsoon (June to Sept.)	N.E. Monsoon (Oct. to Dec.)	Amount Total.
1. Pollachi.	Pollachi.	1·83"	4·93"	17·73"	11·53"	36·02"
2. Central plains.	Coimbatore.	2·80"	5·07"	7·53"	13·45"	28·85"
	Palladam.	1·85"	5·19"	3·85"	11·20"	22·09"
	Udamalpet.	2·27"	4·72"	3·95"	16·19"	27·13"
	Dharapuram	1·49"	4·26"	4·01"	13·12"	22·88"
Average.		2·10"	4·81"	4·84"	13·49"	25·24"
3. Bhavani & Cauvery valleys.	Avanashi.	3·54"	5·47"	7·31"	12·68"	29·00"
	Gobichetti-palayam.	2·32"	6·77"	8·87"	11·39"	29·35"
	Bhavani.	2·92"	5·94"	10·54"	12·06"	31·46"
	Erode.	2·00"	5·63"	8·59"	11·18"	27·40"
Average.		2·69"	5·95"	8·83"	11·83"	29·30"
4. Kollegal.	Kollegal.	0·94"	7·83"	12·71"	7·71"	29·19"
District average.		1·44"	5·31"	8·73"	11·59"	27·07"

From these figures one can easily see that the rains of dry weather are scanty everywhere and are not of much value for cultivation. They may be of use to crops under wells, tanks or channels but are not of great economic importance. It is also seen that the bulk of the large area of unirrigated crops is dependent on the South-west monsoon. There is much uncertainty indeed every year as to the possible amount and distribution of rainfall.

With regard to the prevailing winds there are first the Monsoon winds, the South-west blowing from the South and South-west from June to September and the North-east from the North-easterly direction from October to January. From January to April the winds are from the North-east and East and in April and May it is almost from the South when it is followed by the South-west Monsoon winds. In connection with these Monsoons mention has to be made about the importance of the Palghat Gap in so far as it influences the climate of this district. Those taluqs which are placed close to the gap such as Coimbatore and Pollachi enjoy a very salubrious climate and Pollachi being nearer of the two has

the advantage of the earlier Monsoon rains while it has the disadvantage in that it has to bear all the severity of the Monsoon wind. The district as a whole enjoys a fairly good climate on account of the Palghat gap. As a matter of fact one very much doubts if even Coimbatore in spite of its fairly elevated condition in certain parts can ever enjoy this pleasant climate if it were not for this gap. The gap has not only made Coimbatore climatically so agreeable but has also made it possible for the district to establish easy trade with the districts lying immediately to the West of the gap, namely, Malabar and Cochin.

Having noted the boundaries, rainfall, prevailing winds and climatic conditions of the district a geographical study of the place will be certainly incomplete if a reference to its soils is not made, for soils together with other factors such as rainfall, temperature, humidity, altitude, prevailing winds etc., determine as to the possibilities of crops that can be raised on them. Though on account of the poor rainfall the country presents almost a barren appearance excepting near about the mountains, the soils are really not so bad as they appear to be. With fair rain and good cultivation they are capable of yielding excellent crops. Under well or river irrigation the soils have proved to be exceedingly productive. The soils are made up chiefly of red sand and gravel with a moderate area of red and black loam. The latter two are the best while red sand is the worst. The poverty of rain on the one side of the picture with the potentialities of the soil on the other have made the Coimbatore ryot very thoughtful and the result of it is he has sunk many wells throughout the district and some of them very deep too and this forms a very characteristic feature of this district. From long time ago these have been put to use for irrigation with the help of cattle. As civilization advanced oil engines were employed and to-day most of them are being replaced by motors worked by electricity the current being obtained from Pykara.

The peasants of this district are made up of the Tamil speaking Goundans, the Telugu speaking Kammas and Vadugans and the Kanarese Vokkaligas and many of the Tottians and Palla castes.

The District has a population of 2,445,064 that is very nearly 24½ lakhs and is the fourth in the Presidency. It has a density of population of 300 to 400 per sq. mile.

As regards transport facilities there are the already established railway lines connecting the district with Madras, Trichy, Madura, Nilgiris and Malabar. Direct communication to Madura was established only recently, the line that was running upto Pollachi being

extended further through Palni and Dindigal. The communication that has been now established between Pollachi and Palghat has made Pollachi a very important commercial centre. The continuation of the Mysore railway through Chamarajnagar upto Hardanahalli which is only within a few miles of Satyamangalam has made it possible to establish easy trade relationship between Mysore and this District. If the proposed lines that is (1) from Satyamangalam to Erode making it possible to go to Mysore through this line (2) from Satyamangalam to Mettupalayam (3) from Satyamangalam to Palni through Gobichettipalayam and Tirupur (4) from Pollachi to Vannanthurai at the foot of the Anamalais—if all these are to materialise then the whole district will be knit with a net work of railway which will considerably help the present industrial position of this district. Besides railway there is an excellent motor bus service run by the U.M.S. company of Coimbatore which makes it possible to reach all places in and outside this district which are not within easy reach of the railway line.

Every one is aware that Coimbatore of today is a very important district especially from an industrial point of view. The reason for this is it is the greatest cotton centre for Southern India and the Tirupur Cotton market is one of the great cotton markets in India. The well-being of a district depends on the well-being of its peasants. If Coimbatore is what it is to-day, the credit really goes to the ryot of the district, who is a fairly hardworking ryot and who spares no pains to make use of every cent of rainfall that is obtained. It is his sweat that has in no small measure contributed to the growth of this place. He is the bed-rock on whom the capitalists of this district, some of them mill-owners, have built up their solid mansions.

Well, the major crops that have contributed to the wealth of the district form the subject of our lecture to-night. The crops of this district may be broadly classified under two main heads, namely, food crops and money crops.

Taking up the money crops: first and foremost among them stands the cotton plant. The cotton plant is familiar to every one in this district. In fact the largest acreage in the Presidency under irrigated cotton is only in this district. The statistical report for 1937-38 records for irrigated cotton 169,813 acres and Coimbatore takes the third rank in the Presidency in regard to unirrigated with 251,337 acres. Having known the position of Coimbatore in the Presidency in relation to this crop it behoves us to know the

position of our Presidency in relation to the rest of India and of India in relation to the rest of the world.

Our Presidency takes only a fifth place in India, Punjab occupying the first place, Bombay the second, Central Provinces the third and Hyderabad the fourth. The United States of America is the largest cotton producing country in the world and India comes next. The figures for 1937-38 are as follows :—

(World's cotton crops (Bales of 500 lb.—000's).

World's total	.. 40,645
U.S.A.	.. 20,646
India	.. 5,663
Russia	.. 3,782
China	.. 3,083
Brazil	.. 2,282
Egypt	.. 2,202

In spite of the large acreage India compares very unfavourably with regard to the yield per acre. In Egypt the yield is the highest—500 lbs. an acre. In U.S.A. it is 180 lbs. and in India it is only 90 lbs. an acre. That India which has so much acreage being second in the world should yet be able to produce only so poor a quantity is really a very sad feature. Well, what may be the causes for this state of affairs. The less favourable climatic conditions of our country form certainly one of the chief causes. We depend entirely on the Monsoon rains. Another potent reason is the poverty of the ryot. He is not only poor but also conservative. It is believed that if he uses fertilizers more liberally the outturn per acre would certainly improve ; but this is a debateable point.

Having considered the production of cotton let us consider our position in relation to its trade. The price that a particular cotton fetches per acre is not in proportion to its quantity only. Quality in cotton is a very important factor. Quality refers to the length of the fibre, fineness, colour, tensile strength etc. There are long stapled, medium stapled and short stapled cottons. The cotton in which the fibre length is below 7|8" is a short stapled cotton, that in which it is above 1-3|8" a long stapled and those intermediate between these two medium stapled. What is called the Sea Island (Gossypium barbadense) is an American long stapled cotton and it is the finest type that can spin more than 120 counts. A large proportion of the American cotton is medium stapled while two-thirds of our Indian

cotton are short stapled. The longer the staple the higher the counts to which it can spin. It necessarily follows therefore that our cotton being short stapled can spin only to low counts and therefore fetch a poor price. If 840 yards can be spun from 1 lb. of lint it is called *one count*. If twice as much can be spun from the same 1 lb. of lint, it is termed as 2 counts or 2's. If 20 x 840 yards of yarn are spun from 1 lb. of lint the yarn is said to be 20's, and so on. At this stage it is necessary for us to look back into India's past and review in brief its performances then, its chequered career in the interim period and its hopes in the future.

Who does not know that India held a very prominent place indeed in the textile world in the past ? Dacca muslins were the pride of our country and it is asserted by people of authority that one of the cottons indigenous to our country supplied the lint out of which the famous Dacca muslins were spun not by machinery but by hand. Even to-day there are weavers in India capable of spinning cottons like 80's from Podupathi while the same cotton can be spun upto 18's only with the aid of the best machinery. Soon after the glorious days of the Dacca muslins the Indian textile industry had almost a total eclipse, and this was due mainly to competition with the West. The industry broke down and weavers were forced to become agriculturists. Some Indian capitalists came forward and established spinning and weaving mills as in the West and during the last 30 years these have multiplied all over India, Coimbatore inclusive. There have been two moves in the textile trade. One is the starting of the mills by capitalists as in other industrial countries like England, America and Japan and the other the inauguration of the Khadi movement as early as 1906 and this considerably augmented at the present day due to the change in the policy of the Government in the matter of encouraging cottage industries.

Before the World War about 60% of the cotton cloth requirements of India were imported mainly from Lancashire. To-day conditions are far different. The commercial production and acreage of Indian cotton have been gradually increasing from pre-war time to the present day. Though the bulk of Indian cotton is still coarse, the proportion of fine counts is increasing steadily. "30 years ago, more than 80% of the total yarn output in India consisted of 20s and coarser whereas in 1936-37 about 56% was of this description. The production of 10s and coarser yarn was actually smaller during the past five years than in the corresponding period of a quarter of a century ago, but the production of yarns ranging from

21s to 30s increased to about 2.5 times, of 31s to 40s more than 5 times and of counts finer than 40s more than 20 times."

The cotton plants of the world may be broadly classified into two groups, viz., the American and the Asiatic. It might interest you to know that the former have 26 chromosome pairs that is double the number of the Asiatic cottons and this difference in chromosome number is responsible for the differences that we see in general between these two types. The American cottons are generally bigger with their plant parts also such as the leaf, boll, lint length, etc., correspondingly larger in size. Coimbatore with its dry climate, and red and black soils seems to suit the cotton crop exceedingly well. Cambodia is the main type of American cotton that is grown in this district under irrigated conditions and only in red soils. Karunganni is the type of dry cotton that is grown mainly in black soils. Cotton is grown as the chief commercial crop in Coimbatore, Avanashi, Pollachi, Palladam and Udamalpet taluqs. Except Kollegal and Bhavani, other taluqs also are growing cotton on a fairly large scale.

The Department of Agriculture has been doing its best in the matter of improvement of cotton. The introduction of Cambodia, a foreign and a superior type of cotton, was the first step and the further improvement of this and the evolving of such valuable strains as CO 2 (College Paruthi), CO 920, and CO 1267 after a very hard strenous and careful experimental work are further evidence of the solid work that the Cotton Specialist and his staff have been doing on the vital crop of this district. CO 2 is undoubtedly one of the best and most popular cotton grown throughout this district. It was evolved at Coimbatore Cotton Breeding Station in 1928 from the bulk Cambodia grown in this district. This yields on an average 15% more than the unselected Cambodia and has a ginning percentage of 33%. It is appreciated very much in the Tirupur market and fetches a very good price too when marketed pure. It is fairly drought resistant. It is now being grown over more than 275,000 acres chiefly in Coimbatore, Salem, Madura, Ramnad and Trichy districts. The Department is selling pure seeds of this strain and there is a very great demand for it.

In this connection it will not be out of place if a small suggestion is thrown for the relief of the unemployed agricultural graduate. In the United States of America it is not merely the Government that supplies pure strains of cotton to the public, it is more the private companies that are responsible for the growing

and the distribution of the several valuable types of cottons grown there. One wonders why our young men should not take to seed farming especially in tracts like Coimbatore, where there is a demand for pure seeds of CO 2, K 1, etc.

Side by side with the improving of the irrigated Cambodia attempts were being made by the Department to improve the dry cotton and this has resulted in the evolving of such valuable types of Karunganni known as K 1, C 7, and 4714.

Tobacco is another major money crop grown in this district. Nicotiana tabacum belongs to a family called Solanaceae. It might interest you to know that tobacco, potato, brinjal, chili and tomato all belong to the same family. Solanaceaeous plants thrive very well in Coimbatore, all of them excepting potato. Tomato has been brought under cultivation in this district only very recently and it is doing so well and the taste for it has also been well developed that it is being grown almost in every house. The varieties of tobacco cultivated are all only local known as Erumaikappal, Usikappal and Vattakappal, so named because of the texture in the first and their respective leafshapes in the latter two. These are useful only for chewing purposes. Guntur leads in tobacco having an area of 123,267 acres, next comes Vizagapatam with 33,473 acres and Coimbatore comes third in the Presidency with 23,237 acres, the crop being grown chiefly in Gobichettipalayam, Palladam and Dharapuram. Tobacco from here is mostly taken away to Palghat from which place it reaches other districts with the name "Palghat Vasana Pugalai."

Groundnut is also grown on a fairly large scale especially in the Pollachi Taluq where they have the advantage of the early South-West Monsoon rains. The Departmental strain A.H. 25 has almost replaced the poorer local variety. The harvested product is easily marketed by merchants who come from Calicut.

Sugarcane is grown only on a small scale in this district especially in Udumalpet which is famous for its jaggery. The Departmental strains CO 213 and CO 290 known as "College Karumbu" are very popular.

Coming to food crops paddy is grown throughout the district especially in places covered by the rivers Noyal, Amaravathi and Bhavani. The varieties issued by the Department are chiefly, G. E. B. 24 (Chinna Kichili), CO 1 (Peria Kichili), and CO 3

(Ottu Nellu) etc. Besides rice there are other food crops, called the millets made up of a group of crops—Jonna (Cholam-Tamil), Sajja (Cumbu-Tamil), Ragi (Kevuru-Tamil), Korra (Tenai-Tamil), Arika, (Varagu-Tamil), Samai (Samalu-Telugu), Variga (Panivaragu-Tamil) and Kudiravali (Oodalu-Telugu) which are *the food crops of the poor. These crops are complementary to* rice. Rice can be grown only in areas which can be flooded with irrigation water while millets thrive in areas of poor rainfall as dry crops in the main season and as irrigated crops under wells during summer months.

Among these cholam and ragi are grown very largely in this district. A word about the value of the millets in general will certainly interest you. To quote the words of McCarrison, one of the experts in nutrition matters, " Cholam and cumbu are intermediate in food value between wheat which is the best and rice which is the worst of the cereals. They contain twice as much fat as wheat and nearly 15 times as much as rice." " Next to whole wheat ragi is one of the most nutritious of cereal grains. Its proteins are not quite so good as those of whole wheat, but it has this advantage over wheat that is contains more vitamin A. It is rich in vitamin B and since the whole grain is always used after grinding into meal or as porridge, ragi eaters rarely suffer from vitamin B deficiency." " Good ragi either alone or with rice when eaten with a sufficiency of milk and milk products or fish, and green leafy vegetables and fruits is one of the best diets used by Indian races."

There is a very valuable Government publication by Aykryod called ' Health Bulletin No. 23' and priced only two annas in which he has very clearly shown that our rice diet is ill balanced and that millets should be consumed more freely with rice. The advantage with millets is that they not only provide food for man but also supply plenty of fodder—about 3 times as much as grain. The Millets Specialist and Geneticist has spared no pains indeed in trying to improve the condition of these crops which are of vital interest not only to the poor ryot but more so to the dumb animals.

To-day we have the following valuable strains evolved by the Department doing very well in Coimbatore and other places. A.S. 29 and A.S. 1098—Periamanjal dry and these are irrigated when they are grown for fodder. A.S. 3533 is specially very good for fodder. A.S. 2095 Chinnavellai is a very popular white cholam

grown for grain. A.S. 809 Chinnamanjal is also equally popular. Among ragi E.C. 593, E.C. 3517 and E.C. 3735 are very good strains.

Among pulses mention must be made about horsegram which has an area more than twice that occupied by all other pulses in this district. Gobichettipalayam and Bhavani taluqs grow this on a large scale.

There are a number of other fairly important crops grown in this district such as the famous blackgram of Bolampatti valley, redgram, chillies etc., and in the space of a single lecture it is not possible to deal with all of them satisfactorily and I will content myself with having given you a peep into the vast mass of plant material that could be successfully grown in this district and the bright future that is before us. If only the contemplated Lower Bhavani Project comes into realisation and if also the projected new lines of railway materialise there is no knowing how much this district will rise in its importance from the economic point of view.

* 'Cole Cultivation' of Paddy in Cochin

By

A. KARUNAKARAN MENON, B.A., L.T.,

'A typical example of the struggle against geographical control by the forces of nature is the 'Cole Cultivation' of Cochin. It is a peculiar type of paddy cultivation on land submerged under fresh water for the most part of the year. These lands are called 'Cole Lands.' 'Cole Lands' are more or less fresh water lakes, situated close to canals and backwaters, and are fed by river and rain floods.

There are several of such fresh water lakes bordering on the backwaters of Cochin, of which the chief are, the Enamakal and Manakodi in Trichur Taluk, and the Kattukampal in Talapilli Taluk. The Enamakal and Manakodi lakes together form one continuous expanse of water, more than twenty-five square miles in area, two and a half square miles of which lie in British Malabar. Three rivers, the Karuvannur, Wadakancheri, and Viyur empty their waters into this area. At two points, Enamakal in the north and Chirakal in the south, the lakes channel out into the sea.

By his singular ingenuity, man there has found out how best to control this environment and utilise such water-logged areas for his own benefit. The outlets into the sea are controlled by bunds or dams provided with sluices, which check the ingress of salt-water from the sea and at the same time allow the free flow of all excess water in the lakes to the sea.

During the South-West Monsoon, that is, from May to August, the whole area is flooded and it stretches to the horizon an endless sheet of water. Many boats big and small traverse the area and fishermen are seen busy fishing with their nets or line and rod. On seeing it nobody can imagine that within a few months this vast sheet of water is to present a magnificent level green expanse of the most luxuriantly growing paddy. The sluices are all now opened and water is allowed to flow out freely. There is no fear

* Being the substance of a paper read before the 26th Session of the Indian Science Congress, at Lahore, January 1939.

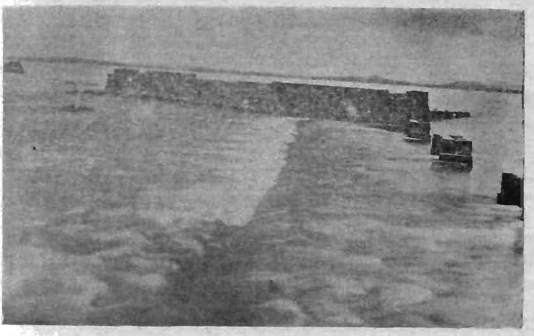
of saline water entering the area, because even the backwaters at this time lose their salinity to a certain extent. But as soon as they turn saline the sluices are erected.

Cultivation of these fields generally begins at the close of the North-East Monsoon, that is, about the middle of December. For convenience of cultivation, the whole area is generally divided into blocks of fifty to hundred acres. Each block is separated from the other by strong impervious high double bunds with a four-to-six feet space between them. This space is used as channel. Cultivavators join together and under co-operative effort pump out the water in the area into the improvised channels. There the water is stored. The bunds and channels are the only means of traversing the area now. Boats have to be employed for visiting the different fields, the dry beds of which lie more than four feet below the level of the water in the channels.

The pumping out of water is an interesting process. Originally it was done with the help of numberless Persian Wheels or ' Chakrams ' as they are called in Malayalam. A ' Chakram ' as the word itself indicates is more or less in the shape of the wheel of an ordinary country cart, with planks of wood for spokes. It is fixed near the mud banks fitted in bamboo framework. Men and even women sit or stand on the bamboo framework and turn the wheel as quickly as they can with their feet. As the wheel turns, the spokes push the water out. Generally numberless ' Chakrams ' are used, men and women continually working at it day and night. But times have changed and the wheels are being replaced by patent pumps driven by engines. The Chakram is a common feature in Malabar and it is used even for emptying ordinary tanks.

Every foot of land thus reclaimed from water is well protected with fences of wattle and mud. When the bed of the field is somewhat dry, light ploughing has to be done in some places. In places where the soil is too soft to admit of ploughing, some levelling at least has to be done. If the soil is made too loose it may become saline and the crop adversely affected. Generally no manuring worth the name is done.

The particular kind of paddy sown here is known as the " Cheera ", a three to four months' crop specially adapted to water-logged conditions. There are a few other varieties also which are specially adapted to water-logged conditions, but they are not tried here for many reasons. The seeds first undergo the process of soaking and then they are broadcast in the fields. Sometimes paddy



ENAMAKAL DAM.

'COLE LANDS' AFTER HARVEST.

plants are transplanted from seed-beds outside. The actual sowing of the seeds takes place about the beginning of January.

In the somewhat raised beds of the fields, especially on the margin, which are not so much water-logged, another variety known as the " Kuttadan " is sown and it takes pretty long time for harvest.

As the plants grow they require plenty of water. The necessary water is now baled in from the improvised channels where plenty of water has been stored. Sometimes there will be occasional showers and there will be too much water in the channels. In that case the excess water in the channels is drained into the sea through the outlets. The success of the cultivation depends entirely upon the right quantity of water being stored in the channels.

Sometimes it so happens that in some years the storage of water may not be sufficient. In this case the crops dry up or fail. Sometimes it may so happen that the crops suffer from too much water. In some years by the time the crops begin to ripen in April, there may be a sudden downpour of early Monsoon rains and there will be steady rise of floods in the fields. All hands can be seen busily engaged in the struggle with the rising floods, which, if not kept under control is sure to destroy the hard earned fruits of a year's labour. It is really a sight to see " the numberless Persian Wheels bristling in the bamboo frame-works, for the contest with the threatening floods, and as the season advances, thousands of people, both men and women, are perched high above the scene on their machine, continuing their day and night struggle with the rising floods for the preservation of the ripening crops." Often the bulwarks of the fields are breached and the immature crops drowned. In that case, even though the crops are not fully matured, people go about in small boats and head the stalks of the rice plants from their boats. But as a rule the harvest takes place about the end of May and an enormously rich crop rewards this remarkable human industry.

Under normal conditions the yield per acre used to be about 1500 to 2000 pounds of grain. The cost of cultivation comes to Rs. 40 to Rs. 45 per acre of which about ten to twelve rupees have to be spent to pump out the water. Cultivators say that year by year cultivation of these areas is becoming a profitless concern, because considering the amount of money and labour that they have to spend on this, the return is comparatively poor. It is high time that better methods for improving the cultivation are found out.

In Central Travancore, bordering on the deltas of the Pumpa river, extensive areas have been reclaimed from the backwaters and are cultivated in a somewhat similar fashion, though the name, 'Cole', is not given to it. Here the water is somewhat saline or brackish; but the crop, usually "Punja" thrives well in that.

It may be pointed out that this type of cultivation is peculiar to a particular region in the West Coast of India where people drain the water from seasonal lakes and tanks into outside and cultivate inside their beds while in the East Coast they retain their water inside for cultivation outside their beds.

Extensive water-logged areas are lying idle bordering on the backwaters of Malabar, Cochin and Travancore. It is worth while experimenting in the cultivation of reeds in these areas, the water-logged condition of which will be really helpful for the luxuriant growth of these plants. Tapping such resources of nature means work for idle hands, bread for many of the starving, and besides, the rise of an industry with a future.

Presidential Address at the Ninth Geographical Conference of the Madras Geographical Association

By

Professor Rao Saheb C. S. Srinivasachariar,
Annamalai University.

It is a source of great pleasure and a matter of pride to me that I should have been called upon by the authorities of the Conference to take part in and preside over this Session held at Madras, just on the eve of the Tercentenary of this City, which will be coming off in the months of August-September of this year. I have been taking some kind of interest in the study of the history and the growth of the City of Madras for the last two decades; and I have rendered my humble bit of service to the Madras Geographical Association itself by reading a paper or two on these subjects and by furnishing illustrative matter for a special number of their *Journal* which reproduced several old maps that serve to show the student the various landmarks in the expansion of the original small settlement of 1639 into the mighty city that it has come to be. I am particularly thankful to my good friend Professor N. Subrahmanyam, who is the life and soul of the Madras Geographical Association and has been the principal instrument for the fostering of a love of Geography and of geographical studies in this Presidency. It is at his suggestion that I might prepare a paper on the 'Historical Geography of Madras' as an appropriate topic on the occasion of the convening of the Conference in the city itself in this historic year of 1939—historic in more senses than one—that I have made bold to follow up his idea and to give expression to a few ideas and features expressive of some of the salient phases in the growth of the original Madraspatam in size, in economic strength, in civic amenities, in population and in appearance through these three centuries that have elapsed since the original English factors built the nucleus of the present Fort St. George, largely with the help of Indian merchants and Portuguese neighbours. It is a matter of pride to all of us who have lived in or, in some way, been associated with, the city that its growth has been continuous and steady and that it has consistently maintained its rank among the great cities of this land of ours.

Madras has had, except for slight and temporary disturbances, an unbroken development for the last 300 years. It is a lucky coincidence that the energetic organisers of the Madras Geographical Association should have made this city which just completes its third century of growth, the venue of this year's session of its annual Conference. From the original site of the village of Madraspatam, which the English acquired by virtue of a grant of the Hindu rulers of the country, the city has grown and grown vigorously sending out its shoots on all sides, assimilating into its civic and economic organisation the surrounding areas stretching down to Pallavaram and Tambaram on the southern side, to Avadi and even Trivellore on the west and going up to Tiruvottiyur and Ennore on the northern flank. The map of Greater Madras as it stands at the present time is and should be an interesting object of study to all students of the historical geography of South India.

Professor E. A. Freeman writing as early as 1881, stressed upon the mutual influencing study of local geography as influenced by local history and of local history as influenced by local geography; and he cautioned the student that the Geographical environment should be very carefully examined in its full bearing whether remote or direct, on the formation of the character of the people. A very remarkably apt illustration of this is afforded by the predominant characteristics of the European settlements on the coast like Pulicat, Madras and Pondicherry that were formed and grew up into some appreciable strength in the course of the 17th century. More of it will be stressed in the further course of this paper.

The neighbourhood of Madras city forms a level land of post-Tertiary formation; and there is no part of it which is higher than 40 feet above sea-level. The eastern part of the city is built on a dune running along the coast, while to the west of it can be clearly traced a parallel trough to the West of George Town and Washermanpet, from the People's Park to the Trevelyan Basin and then continuing on to the Ennore back-waters. It was through this trough that the North or Elambore River (as it was called in the East India Company records) flowed into the Cooum (near the Stanley Viaduct). "This feature of dune and trough running parallel to the coast can be traced for miles North and South of the City; and advantage has been taken of its existence in constructing the Buckingham Canal." Surf beats continuously on the coast and the soil is an admixture of sand and loam suitable especially to palm growth. The surf-driven sand moving very near the shore-line is another feature of the locality. Being obstructed by the projecting arms of the harbour from going northwards, the accumulation of

sand has resulted in the accretion of a gradually widening fore-shore that is immediately to the south of the Harbour and that diminishes its width in the south. The Harbour has also been responsible for the erosion of the beach along Royapuram and Tondiarpet and for some distance further north.

As has been elsewhere remarked by a high authority, the Madras elbow has been the vital point of the coast country, viz., the Palar Valley and the hinterland up to the Ghats. This makes it clear that "Madras was the parent of the port, not its child." The encroachment of the Pulicat Lake on the narrow lowland between the outlying spurs of the Seshachallam Hills and the sea narrows the approach from the north to Madras ; and even this is broken up by the Nagari Hills, which served as a prominent landmark, being visible 50 miles from the shore and greatly useful to the early European seamen. To the south the hinterland is broken by isolated hillocks of which Gingee group of hills has been historically most prominent and the Tiruvannamalai peak is another landmark rendered sacred by its religious associations. Directly to the west of Madras, in the interior, there are the Javadi hills marked by two flanks, the Arcot-Wandiwash flank on one side and the Vellore flank on the other. The latter was considered by the English the more important of the two, because the base of political power in the 17th and 18th centuries was "on the plateau behind and not on the sea in front." The position that Madras occupies has thus been "as important politically from the landside as from the sea, in earlier days. It is now provided with a large harbour ; and the facilities it possesses for inland water-transport deserve better use and encouragement than they enjoy now. It may be objected that the Madras Harbour cannot become a really valuable one, but one merit that the City possesses has been that "as the poor land was not valuable, there was little demand for it," and so the city sprawled and spread out in its growth. It is one of the "widest spaced" cities in the world ; and its spread-out elbow has contributed to its geting a rainfall that is more than normal for the rest of the coast.

One reason not noticed usually by students of history for the selection of the site of Madraspatam for their settlement by Day and his colleagues was that the neighbourhood offered advantages in the matter of securing of cloth that was so much in demand for export to Europe. In his journey of examination of the possibilities of Madras, Day found, after comparing the cloths woven in the locality and their prices with those prevailing at Arumugam, their northern settlement, that the latter were in excess of the former by 20, 30

and in some cases even 40 per cent. The availability of cheap cloth was the first consideration of the English settlers; and the abandonment of Arumugam which was the preliminary step for the establishment of Madras was due partly to this factor and partly to the fact that its Nayak was continuously forcing. Another letter of Day tells us what kinds of cloth suitable for export to Europe were available at the then flourishing port of San Thome to the south and whether Madras itself would afford facilities for obtaining the different kinds of cloth cheaper by 20 per cent than anywhere else.

The fairly dry piece of sand-bank between the Beach and the North River just above the point where it meets the Cooum at its mouth, was suitable for a fort and it was also a further recommendation that a normal ship of those days might ride or was deemed to be capable of riding at a distance of a musket shot, close by the river (Cooum). That the Cooum should have been so much of an open river in those days was an additional factor that disposed the English merchants to choose the site, while San Thome, the neighbouring Portuguese town was not considered at all a serious rival.

The Fort was actually built on the small spit of land granted by the Nayaks of Poonamalle (Damarla Venkatadri and Ayyappa) on behalf of their suzerain of Chandragiri. The site lay between the sea, the mouth of the Cooum River and the so-called North River flowing parallel to the sea and joining the Cooum at its mouth. To the north or north-west of this site lay the village known as Madraspatnam which had been in existence prior to the settlement of the English. The origin of this name Madraspatam has not been very clearly ascertained; it is attempted to be derived from the name of one Maddaraju who might have been a lord of the locality; from Mandarajya (the land of the benighted); from Madre de Deus, being the appellation of a Portuguese Church which was held to have existed at the village for some time; and lastly from the Christian family of Madras (Madeiros) which, as attempted to be established by the Most Rev. Monsignior Teixeira of Mylapore, was the name of the most prominent Portuguese Christian family of the neighbourhood. Other views hold that the name Madras was derived from the word, Madrasa=Persian (College) and from Madraskuppam, the name of a neighbouring village.)

The Fort and the town which grew immediately to the north side of it came to be termed Chennapatnam by the Indians, in

.eference to the wishes of the Nayak of Poonamalle who wanted o have the town named after their father, a well-known Chief by ıame Chennappa Nayak. Thus the site of the present Fort was ıriginally called Chennapatnam ; and the village lying to the ıorth and north-west of it was Madraspatnam. The English preerred to call the united Indian town and Fort by the name of "Madraspatnam with which they had from the first been familiar"; ınd the Indians have elected to use the name Chennapatnam.

The earliest Fort built by the first English settlers was a small square structure whose building was carried on to completion by he intrepid founders, Francis Day and Andrew Cogan, in spite of lack of money and positive discouragement from the Directors of the Company at home. It was several years before the building (the Factory House) came to be surrounded by a protecting wall. This was the Inner Fort containing the quarters of the merchants and factories and the barracks of the small garrison, the former living along with the Governor in the Factory House itself, and the latter under the curtains of the walls.

Outside the Inner Fort there grew up houses and streets inhabited by the free English merchants of those times and others, Armenians, Jews and Portuguese, who came from the neighbouring settlements of San Thome (now forming a suburb of the city to the east of Mylapore) and some privileged Indians. This quarter, known as the European quarter, Christian Town or White Town, came to be walled in later, these outer walls being provided with bastions at the cardinal points, and thus forming the Outer Fort enclosing in its centre the Inner Citadel.

In the 17th century and in the first half of the 18th century the space occupied by the Fort was much smaller than the area of the present one. It was oblong in shape, broader on the north side than on the south, and occupying an area of only about 15 acres. The river on the west then made a much wider sweep to the east and flowed along the middle of the present Fort. The rather thin outer walls were protected by bastions at the corners and a sort of ditch on the sea-side. On the western side there was only the shallow North River, which was easily fordable while on the north (in the area now occupied by the outer glacis of the Fort, the Wireless Installation and the High Court and Law College Parks) there was the crowded Old Black Town (otherwise known as the Gentue (Telugu) or Malabar (Tamil Town), the streets and houses of which ran almost into the Fort itself.

It was found that this proximity of the Black Town was a great source of military weakness at the time of the French wars of 1746-61. When the French got possession of the Fort in 1746, they set about strengthening its fortifications, enlarged the bastions and walls of the Outer Fort and demolished the houses in Black Town clustering near the north wall of the Fort. They thus destroyed a great part of the picturesque Old Black Town and created the north glacis of the Fort; but they left its interior fairly intact. When the English got back Madras in 1749, much of the Old Black Town had been destroyed. The English government were advised by their generals to extend the open space thus formed, demolished the remaining houses standing in the Town as well as its walls and left only the Town Temple of Chennai Kesava Perumal intact—as the solitary monument of the vanished place. Even this they pulled down in 1757 on the eve of Lally's siege of the city; and its bricks were used up in strengthening the walls of the Fort.

The Indians now shifted to the hitherto sparsely populated suburbs of Muthialpetta lying to the north and Peddanaickenpetta lying to the west of Old Black Town; and these came to be called the (New) Black Town, a name which they retained till the visit to the City in 1906 of H. I. M., King-Emperor George V, when he was Prince of Wales. On that occasion to mark the event, the name was changed into the present George Town. Both Old Black Town and New Black Town were walled—a measure of precaution taken against the raids of the local chiefs on the former and those of Hyder of Mysore on the latter. The walls of New Black Town were built in the seventies of the 18th century and only covered the exposed northern and western sides, running from Clive's Battery on the Rayapuram Beach westward to the neighbourhood of the present Basin Bridge Railway Station and thence southwards, parallel to the present Wall Tax Road, down to the General Hospital corner. The walls were substantial and provided with bastions and flank-works at intervals; and they were pierced by numerous gateways. About the middle of the 19th century when swords were beaten into ploughshares, these walls were pulled down; but portions of them can be seen still standing, near the Royapuram Stanley Medical College and to the north of Old Jail Street. These walls of New Black Town were faced on the outer-side with a broad glacis—a remnant of which, on the western side, has been converted into the present People's Park and the grounds of the Salt Cotaurs.

Peddanaickenpetta and Muthialpetta, which formed the nucleii of New Black Town, were originally suburbs of the first Indian city. The former was named after the Peddanaick who was the hereditary

chief of the police of the Indian Town. Muthialpetta and Pagadalpetta (Pearl-town and Coral-Town)—the latter name has fallen into disuse, though still embodied in the present Coral Merchants Street —were originally streets of the traders in pearls and corals, many of whom were Armenians and Jews. The Armenian Church and Cemetery at the southern end of the present Armenian street are the sad remaining relics of the Armenian colony which was once so prosperous an element of the trading community of Madras. The small Jewish Cemetery, buried in a part of crowded Mint Street is similarly indicative of the Hebrew colony that flourished in Madras in bygone times. Some of the Jews were English and others were Portuguese. "Most of them were diamond-merchants, on the look-out for diamonds from the mines of Golconda, which were formerly very productive. Several Armenians of note have left their impression of the city. One of them was Coja Petrus Uscan who owned houses in the Fort and built the Saidapet (Marmalong) Bridge over the Adyar river, as well as the stone-steps leading to the church at the top of St. Thomas Mount.

The English Company traded largely in calico cloth ; and hence the necessity for securing a large body of painters, weavers, washers and dyers. Government had always been anxious to encourage their settlement ; but they required large open spaces for their operations and hence had to be housed outside the crowded Black Town. Towards the close of the 17th century Governor Yale (1687-92) settled a number of weavers in the street that is now known as Nyniappa Naicken Street, while the washers (washers of cloth and not washermen) were housed in the present Mint Street. These streets were then outside the Old Black Town, in the suburb of Peddanaickenpetta. Later when the settlement grew in trade, Governor Joseph Collett settled a number of weavers in a suburb near Tiruvottiyur ; and the village was first named Colletpetta after him, though now corrupted into Kaladipetta (*lit.* Loafers' Refuge). The present Washermanpetta is reminiscent of such a suburban settlement of washers ; and the village of Chintadripetta, lying to the west of the Island Ground, was formed about 1735, particularly for the weavers to settle in ; and special privileges and advances for building houses, etc., were given to them ; and it was declared that none but painters (designers of patterns for chintz cloth), weavers, spinners and dyers and washers (bleachers of cloth) and such others as might be servants of the temple should settle there.

Triplicane, rendered famous by the Parthasarathy Swami Shrine, which goes back to the times of the Vaishnava Alvars and

which was the first village to be acquired by the English after they got Madras, is noteworthy. From the first it connected the City of Madras with the Portuguese San Thome which included the temple village of Mylapore on the west of it; and through it ran the high road connecting the Island Bridge with San Thome. The Triplicane temple was always an object of care to the Company who entrusted its management, along with that of the equally famous Town (or Chennai Kesava Perumal) Temple to their Indian Chief Merchants and set apart certain small items of revenue for their maintenance.

It was in the open ground adjoining Triplicane on the north and abutting on the southern side of the Cooum mouth, that the Governor came to have his Garden-House (first acquired in 1753 and now enlarged into the Government House and Banquetting Hall), and Nawab Muhammad Ali, Wallajah, who after he became a dependent of the Company and loved to reside for most of the time in Madras, built the stately pile now known as the Chepauk Palace, part of which has been converted as the offices of the Board of Revenue. The Nawab's Palace grounds originally covered all the area from the Cooum mouth on the north to Pycroft's Road on the south and stretched inland as far as the present Bell's Road on the west.

The Governors always used to have a Garden-House outside the Fort where they could retire for week-ends and on sultry evenings and in which they used to entertain Indian potentates and European visitors. The earliest Garden-House of the Company was situated in a corner of Old Black Town. Owing to the pressure of the growing population, it was superseded by a larger and more finely-laid-out Garden-House situated at the southern end of Peddanaickenpetta, in the ground of the present Medical College and General Hospital.

The Island itself was a marshy swamp laboriously levelled up and was formed by the bend of the North River to the east and then to the south till it reached the Cooum mouth. The Cooum itself makes a huge S-shaped curve as it runs into Madras and flowing past Chintadripetta, comes very near the North River. At this point a canal was cut, now crossed by the Penitentiary Bridge and the Stanley Viaduct connecting the two rivers. This canal and the joint mouth of the two rivers help to make the Island. Till about 1750, the North River ran much farther east; and it made a bend to the south only in the middle of the present Fort, thus rendering the Island more spacious than it is now. A bridge led from Peddanaickenpetta to the Island, near the Governor's Garden House;

and another, the nucleus of the present Wallajah Bridge, led from the Fort on its western side across the river to the Island and thence on by a third bridge (on the site of the present Government House or Willingdon Bridge) to the Triplicane High Road and the (Mount) Road which led on to the Mount.

The French destroyed the Garden House in Peddanaickenpetta during their occupation of Madras (1746-49). A private garden-house in Chepauk (the nucleus of the present House) was first rented and later purchased from its Portuguese owner, Mrs. Madeiros, a few years after 1750. It was subsequently enlarged on several occasions; and its grounds were extended on the west by the diversion of the Triplicane High Road (which then ran in a direct line from where it terminates at the Chepauk Police Station to the bridge), to its present alignment along the Wallajah and Mount Roads and later by the inclusion of a part of the Nawab's Palace-grounds. On one occasion the Government House was raided by Hyder's troops led by his son Tipu Sultan. The French General, Count de Lally, was kept a prisoner here for some time; and more than one Governor had died within its walls.

Lord Clive, Governor from 1798 to 1803, the son of the Hero of Plassey, greatly improved the Garden-House, and built the beautiful Banqueting Hall by its side to commemorate the fall of Tipu and the English capture of Seringapatam; and "with pious respect for his dead father's memory, (he) coupled Plassey with Seringapatam and ordered that the fine figure-work on the facade of the Hall should be a commemoration of both the vicotries." The Banqueting Hall resembles the Parthenon of Athens, being of the octastyle and Doric order. A few additions have been made to it since, like the terracing of the side-verandahs. On the walls are noble pictures of several former Governors, Viceroys and Commanders-in-Chief, besides those of King George III and Queen Charlotte, Major Lawrence and Nawab Wallajah, and emblazoned mouldings of the royal arms and those of the East India Company. In the Government House also are some fine pictures of historical personages. Later, when the Governor abandoned his house in the Fort and came to live permanently in the Garden-House of Triplicane, the necessity was felt for a country lodge to which he might retire on occasions; and the extensive Guindy Lodge near the Mount and the Race-Course was acquired in the course of the first half of last century.

In those days there was no road on the beach; nor the broad Marina which is the pride of Madras. Till 1846 there was no beach road at all running along the east side of the Fort. It was the prac-

tice for men to retire to their garden-houses in the evenings, or to ride about in the Mount Road—unlike as now when they 'eat the air' in the beach. The surf of the sea washed against the stone rivetment of the ditch which flanked the eastern wall of the Fort. The surf was within 20 or 30 yards of the walls, and the spray beat into the Fort on stormy days.

Besides Triplicane the city absorbed the famous town of San Thome de Meliapur. San Thome had long been associated in Christian tradition with the Apostle Thomas and contained from very early times a small Christian community and Church. The Portuguese formed a monastic settlement at the place about 1522 and soon a town grew up which became prosperous, though after a time it was injured by foreign aggression and internal strife. It was a fortified place and served both as an object of acquisition and an eyesore to Madras, and formed a veritable Pandora's Box of political and military troubles and confusion. It was successively taken possession of by the Dutch, the French, the Muhammadans of Golconda, the French again and then the Golconda and Mughal rulers. Portuguese authority was limited to the European quarter. The Muslims ruled over the neighbouring town of Mylapore. The fortifications were so effectively destroyed that not a trace of them remains to-day except fragments of a redoubt to the south of the present Cathedral. San Thome and Mylapore, which is historically even more important than Triplicane, having venerable associations with the sage Tiruvalluvar and some of the Saiva saints and Vaishnava Alwars, were acquired by the English by grant of the Nawab after a forcible occupation by their Admiral Boscawen.

Even within fifty years after the foundation of Madras, the English felt the need for expansion and acquired. after the usual protracted negotiations, in 1693 from the Mughals, the three outlying villages of Egmore and Purasawakam on the west and Tondiarpet on the north. Egmore was the first to be occupied. These three villages were long known as "the three old towns" or including Triplicane, "the four old towns." In 1708 after great troubles, Nawab Daud Khan gave a grant to the English for the five outlying villages namely, Tiruvottiyur, Nungambakkam, Vyasarpady, Kattiwakam, (near Ennore), and Satthangadu to the west of Tiruvottiyur. These came to be known as the five new villages as distinguished from the older ones.

Thus in the 18th century, new settlements were made in some of these acquired villages and in the intervening spaces between

them, mainly by the washers and the weavers of the Company's cloth. Thus rose up the weavers' village in Triplicane, now known as Tiruvettiswaranpetta, Collettpettah formed by Governor Collett, who settled 400 weaving families therein, Washermanpettah and Chintadripettah, which was founded in 1735 as a special Mirasi village for weavers, washers and painters of cloth and for the Brahmans of the temple and its other attendants. Periamet was the great Metta or place of toll-collection at which the *Sunkam* dues were levied for long by the Indian rulers on the goods coming into Madras. It continued to be even under British occupation an octroi station, a land customs house with the usual godowns and customs choultry.

The Choultry at Egmore was early converted into a redoubt for the protection of the Fort from attack from the interior. The redoubt fell into ruins about the close of the 18th century and the open space between it and the Spur Tank soon came to be covered with residential houses.

The village of Vepery, lying wedged in between Egmore and Purasawakam (known also as Ypere, Vipery, Ipere in the records) was mixed up with the Company's villages, " intermixt in the middle of our new Towns and in the troublesome place for receiving the Nabob's Junkam." The English applied for its grant, soon after they got the old villages, i.e., in 1695. But it was only in 1742 that they received it actually from the young orphan Nawab Muhammad Said of Arcot. That Nawab was a guest of the English Governor of Madras at the time when his father Safdar Ali was assassinated and he showed his gratitude to his host by granting the English the five villages of Eranavore, Sadiankuppam (both near Thiruvottiyur), Vepery, Perambore and Pudupak as well as the right of coining Arcot rupees and pagodas.

While about 1750 Triplicane was the favourite residential quarter for the Europeans and substantial residences near Government House had arisen, there were a few residences erected in Egmore and Vepery also. Edmund Maskelyne, Clive's brother-in-law obtained a piece of land in the angle formed by the present Perambore Barracks Road and the Purasawakam High Road which was later on bought by the Nawab and which is even now called Maskelyne Tottam. Gradually the number of such residences increased not only in Vepery but also in Komaleswaranpettah, Pudupakkam, Pudupet and in the large space of ground known as the Choultry Plain. This last was the large and open area which lay to the south of the Tripli-

cane River—which lay between Triplicane-San Thome Road on the East, and the long Tank on the west including the villages of Nungambakkam, Tenampet and Royapet. It was traversed as far as the Long Tank by the high road from the Fort to the Mount. It was so called from White's Choultry which was a prominent sight in the locality, and the first residential building which was erected on the plain is supposed to be "Mackay's Gardens" built by George Mackay. There had grown up by 1780 about 500 to 600 garden houses in the Choultry Plain.

Thus through the eighteenth century the acquisition of land by the Europeans for garden houses and residences was going on to the south-west of the Fort. "As the British acquired the suburban villages, Peddunaickenpetta lost its popularity, and Triplicane rose in favour as a residential quarter. Prior to the capture of Madras in 1746 (by the French) a group of country mansions had arisen on the south side of Triplicane bridge and when the Company purchased one of them for the use of the Governor, the area traversed by the Mount Road was marked as the building site of the future. That area was the Choultry Plain where uncultivated ground was available."

The growth of residential suburbs towards the south in Adyar, and along Mowbray's Road has resulted in the expansion and extension of the city in the course of the last half a century over the area of the Adyar village and the neighbouring Guindy. The swamps and open spaces stretching southwards beyond San Thome and on both the banks of the Adyar are gradually being reclaimed and covered with very fine garden houses and residential buildings.

Towards the west we find equally virile signs of growth and expansion. The chief suburbs in this area are Perambur, Choolai, Vepery, Purasawakam and Kilpauk. The mill area is situated in the wedge between Perambur, Vepery and Basin Bridge at the north-west corner of George Town. Originally all this area was a low-lying swamp. But a portion has been reclaimed and drained by the prosperous Buckingham and Carnatic Mills, which have set an example to Indian industry in the conditions of employment they offer to their workmen. The building of railway yards in the neighbourhood of Tiruvottiyur, the large railway workshop in Perambur and similar industrial activities, though on a much smaller scale, which have grown up in this area, have converted this part of the City and its environments into what may be called pre-eminently "Industrial Madras", as contrasted with the new

residential quarters, planned on a very tempting basis and equipped with fine roads and open spaces in the reclaimed areas of the Spur Tank, the Nungambakkam tank and the long tank of Mylapore, which has resulted in the growth of thousands of beautiful villa houses on both sides of the Mount Road and of the Poonamallee High Road and in the open spaces intervening between these two axial highways of the city. Both these roads were military in origin and built for military purposes. The Beach Road and the Marina testify to their peaceful aims at developing trade and promoting recreation. The Triplicane—San Thome High Road is even older than the town of Madras and connects the important places of Mylapore, Triplicane and the city. Formerly it was projected across the Island by a bridge leading into the heart of Peddanaickanpetta. The last great axial highway is the Esplanade—Broadway—Tiruvottiyur High Road, leading to the north through suburbs, whose prosperity depended on their weaving activity and has now begun to show signs of decline.

George Town itself which with its brisk trade of all kinds, great banking and commercial houses and growing harbour still remains the heart centre of the expanding city. It has been separated from the Fort in the 18th century by a large area of Esplanade ground created for military purposes; and it had to adjust itself consequently to the indented outlines of the Fort walls and outworks. It has as a result an indented outline itself on the south-eastern side.

The Municipality originally chartered as the Mayor and Corporation of Madraspatnam in 1687 has grown along with requirements of the expanding city and begun to take in areas which have recently grown up, particularly the new residential quarters by the side of the long tank and to the west of Mount Road across the Long Tank into the village of Mambalam. Its limits now go up to the South Indian Railway line near Saidapet. Saidapet, Guindy, St. Thomas Mount and Pallavaram, and possibly Tambaram can be deemed to be the southern out-areas of the city. Similarly all the suburban quarters beyond Perambur and upto Avadi on the west and round about Tiruvottiyur stretching as far as Ennore, may be said to form integral portions of Greater Madras.

Thus Madras has grown gradually, and in the last decade in a very wonderful and striking manner. It has had necessarily to become "the city of distances" which name it deserves in a peculiarly appropriate manner; "for within its limits there are some

magnificent spaces." The original nucleus, the native town was not laid out on any definite plan; nor was any definite scheme followed except here and there on the building of the suburbs. The City has got more than a due share of mean slums and narrow straggling streets; because it had to be allowed to grow just as it would. "But Madras is a fine city nevertheless, with a number of stately buildings, both public and private and with great possibilities." Its greatest charm lies in its steady growth and expansion. "The City has grown from strength to strength and in its story there is much inspiration." The electrification of the South Indian Railway's suburban service, the busy plying of motor buses along all the principal roadways, and the construction of overbridges at several of the congested level-crossings, have contributed, along with the electric tramway service, to serve the needs of quick locomotion and encouraged a larger proportion of the population to live in the suburbs going into the City for their daily avocations.

Port of Madras

By

Mr. C. C. Armstrong,

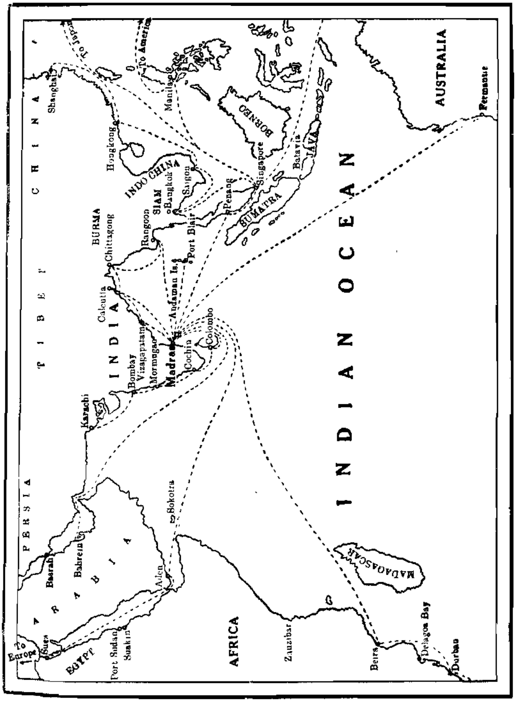
Chairman, Madras Port Trust.

Position of Madras in the World.—If we want to appreciate the geographical situation of any place, the first thing to do is to look at it in relation to the world in general, that is, to look at a map ; and if we want to consider the geographical position of a port, the first thing to do is to look at it in relation to other ports of the world.

If then we take a globe showing the map of the world and turn it so that Madras is directly under our eyes, what do we see ? The first thing we see is the Indian Ocean with the large country of India lying on the northern edge of it, and we see that India extends southwards towards the middle of the Indian Ocean and that the Port of Madras is situated near the south-eastern corner of India.

Looking round the Indian Ocean we see other ports. First, in India itself there are Calcutta about 759 miles from Madras, Bombay about 1,453 miles from Madras by sea, Karachi about 1,915 miles from Madras. Then in Ceylon we have Colombo about 580 miles from Madras. Looking to the east we find Burma with the large port of Rangoon about 1,000 miles from Madras and further south Singapore about 1,591 miles from Madras. On the western side of India we have the ports of the Persian Gulf and further west is Africa with its ports of Zanzibar, Beira, and Durban ; and right away down in the south across the ocean is Australia. Round the other side of the globe, and quite out of our view as we look at it, are other great ports of the world, many of them connected with Madras by links of Steamer Lines.

It is a good thing to begin our subject by making Madras appear as if it were the centre of the world, but when we come to look closely we find that Madras is only one of the ports of India and actually cannot compare in importance with its large sisters of Calcutta, Bombay, and Karachi. At the same time it can be easily seen that its geographical position near the south of India on the Bay of Bengal gives it a favourable position for exchanging



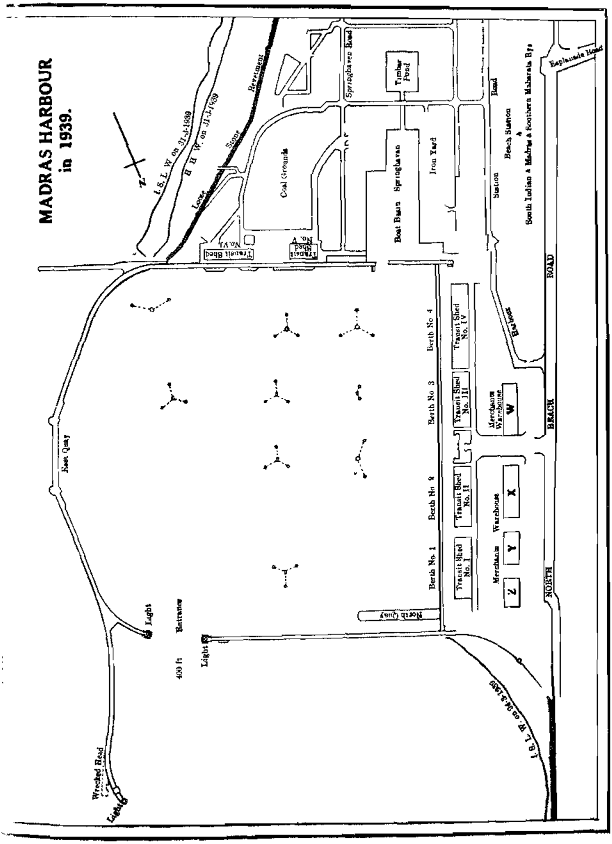
POSITION OF MADRAS IN THE INDIAN OCEAN.

trade with Burma, Singapore and the Far East, with Australia in the south and Africa in the west.

Madras Past.—Let us consider next the place itself. It is perfectly easy to see why Calcutta has become a great port. The reason is that ocean-going ships are able to penetrate 200 miles up the Hoogly River into the heart of the rich country of Bengal. Bombay again is a wonderful natural harbour with land-locked bays. Karachi also has the natural advantages of deep water combined with smooth water. Cochin, which may prove some day to be the principal Port and City of Southern India, has the advantage of smooth and deep water, a land-locked harbour, where ships can lie in safety. But what advantage has Madras got and why has this great City grown up in this particular spot ?

In the south-west corner of France in Europe on the borders of the Atlantic Ocean there is a large port which owes its existence to the fact that a broad navigable river at this point runs into the Atlantic. And there is a well-known saying in that part of the country that, if the river had only chosen, she could from her source in the hills very well have run in a different direction and not at all into the Atlantic Ocean and that, if this had come about, the great port would never have existed. But the river did not wish to go elsewhere and so the great Port of Bordeaux came into existence.

The beginnings of Madras were apparently even more accidental. An English sailor named Francis Day cruising along the coast of Coromandel looking for a convenient place in which to open a trading station, found a bare sand bank next to a pleasant stream flowing into the sea and protected by a marsh behind the sand bank, and he came in and settled there. The sand bank became the foundations of Fort St. George ; the marsh was drained and became the Island which we all know so well and the pleasant stream became in course of time the muddy and sometimes offensive river Cooum. From its earliest days Madras was a port. That was the reason for its existence ; to do trade between India and the world outside India. But, though it was a port, it was by no means a harbour. Ships used to lie without any natural protection outside the Fort opposite the Legislative Council Building, quite close to where the sea used at times to break into the Fort moat. Ships could only come here when the winds in the Bay of Bengal were favourable and, when there were storms, they were frequently wrecked.


MADRAS HARBOUR
in 1939.
N
I. S. L. W. on 31-3-1939
H. H. W. on 31-3-1939
Loose Stone Revetment
Springhaven Road
Timber Pond
Coal Grounds
Boat Basin
Springhaven
Iron Yard
Road
Station
Beach Station
South Indian & Madras & Southern Mahratta Rys
Esplanade Road
Transit Shed No. VI
Transit Shed No. V
Berth No 4
Berth No 3
Berth No 2
Berth No 1
Transit Shed No. IV
Transit Shed No. III
Transit Shed No. II
Transit Shed No. I
Merchants Warehouse
W
X
Y
Z
Harbour
NORTH BEACH ROAD
North Quay
East Quay
Light
Entrance
400 ft
Light
Wrecked Head
Light

As the City of Madras grew and the Fort became too small for all the activities of the citizens, the present George Town began to grow, the Custom House was moved up to its present site and the ships left the front of the Fort and came up northwards to the site of the present harbour. Then, 250 years after the founding of the port, the Madras Harbour was built.

Now, why has Madras, the Capital of this great Province, never achieved the size and wealth of Calcutta and Bombay? The reason is partly in her port and, if you are going to understand at all the reason why Madras Port is so much smaller than the ports of Calcutta and Bombay, you have got to realise first of all that these two latter have always been natural harbours and that, while full protection to ships is given by nature at Calcutta and Bombay, at Madras no protection to ships has been given by nature. The whole of the protection enjoyed by ships in Madras to-day has been provided by the efforts of the Government, the Traders and the Engineers, all of whom did their part in building the Madras Harbour. There are no doubt other reasons—there are plenty of historical ones—why the City of Madras is not so great a City to-day as Calcutta and Bombay; but, apart from these reasons, the hand of nature, in failing to give ships the shelter of a harbour at Madras in the old days of sailing ships, has had a great deal to do with limiting the size and importance of our City.

Madras Present.—Madras is situated in the middle of the east coast of India. I believe that this east coast is a steadily eroding coast, that is the action of the waves persistently washes away the sand of the sea shore and the sea encroaches on the land. But what the coast loses from the action of the waves is made good by the soil brought down by the big rivers such as the Godavari, Kistna and Cauvery. Throughout the year the sand of these rivers is being washed by wave action northwards or southwards along this coast. During the south-west monsoon the wave action washes the sand northwards and in the north-east monsoon it washes the sand southwards.

Any obstruction built out into the sea from the shore stops this sand movement and the sand begins to accumulate up against the wall or whatever the obstruction may be. As the movement from the south continues for more months in the year than the movement from the north, the effect of any obstruction built out into the sea, as for instance at Madras, is for sand to accumulate on the southern side of it and to tend to disappear from the

northern side. So we have land accumulating south of the Madras Harbour and subsiding into the sea north of it.

When the building of the Madras Harbour was under discussion this natural fact was perfectly well-known and one of the original proposals was not to build a harbour enclosed by walls but simply to build a break-water parallel with the shore and about 1,200 yards from it; the idea being that ships could come and lie in fairly smooth water between the breakwater and the shore, but the actual movement of the sand up and down the coast would not be interrupted. However, there were many objections to that scheme, and the extent to which the sand would accumulate against the obstruction of the harbour walls was not thought to be serious. So the harbour was built in its present form.

The first harbour was finished in the year 1889, but unfortunately the rate at which the sand would accumulate on its south side was underestimated and in a very few years the sand began to obstruct the entrance of the harbour, which in those days was on the eastern side of the walled enclosure. It was, therefore, decided to do what should have been done in the first place and that was to make the entrance to the harbour on the north side instead of the east. This was done; only the two towers flanking the eastern entrance were left standing as they are to-day, the gap between them was filled up and the northern entrance opened in the year 1910. But again only fifteen years later it was found that the sand was accumulating at a rapid rate south of the harbour and there was fear that it would begin to obstruct the northern entrance also. So an additional arm, now called the Sand Screen, was built out eastwards in extension of the south groyne of the harbour in order to prevent the sand being washed across the entrance. This has been effective so far, but there is reason to fear that it will not be effective for many more years and that further measures will have to be taken. This important question is now engaging the attention of the Port Trust Board.

At the same time as sand is accumulating on the south side of the harbour the coast is being washed away on its northern side and probably what has been washed away is nearly equal to the quantity that has been added to the land south of the harbour. About 500 acres of new land have been added opposite the Fort, Royapettah, Triplicane and Mylapore; in fact the whole sea front of Madras has been materially altered by the building of the harbour half a century ago.

From sand-movements let us pass to cyclones. It may be said that Madras is famous for its cyclones, and yet it is a very curious thing that cyclones almost never strike Madras with their full strength. Their centre nearly always crosses the coast of India north of Madras, usually towards Masulipatam, or south of Madras in the neighbourhood of Cuddalore. It is probable that the shape of the eastern coast of India has something to do with this, for at Madras the coast bulges out slightly to the east and leaves Masulipatam on the north and Cuddalore on the south in bays. In the last eleven years that I have been connected with the port, certainly twice and I think more often, a cyclonic storm has approached from the Bay of Bengal and was apparently destined to pass right over Madras, but on each occasion the cyclone got weak and petered out before it reached the coast. On the other hand much the most serious storm of recent years, that of November 1930, had its centre at Cuddalore one hundred miles to the south of Madras and the previous bad storm of 1916, when the outer arm of the harbour was washed away, was also a Cuddalore cyclone.

It is very fortunate that it is tolerably easy to predict the movement of these cyclonic storms. The port always has warning when a cyclone is beginning to form. It usally starts as a depression somewhere in the Andaman Sea moving west or north-wes and it may take anything from twenty-four to seventy-two hour to come across the Bay of Bengal. A cyclonic storm consists c strong winds blowing in a circle and the centre of the circle the core of the storm. These winds always blow in a particula manner that is, in a contrary direction to the movement of th hands of a clock. This circle of winds, which is commonly know as a cyclone, moves across the Bay gradually increasing in streng and, when it reaches the coast, it dissipates and brings down to rents of rain. Any ship in the Bay passing near one of the storms can tell by the direction of the wind whereabouts th centre of the storm is because the winds always blow in a dire tion contrary to the movement of a clock's hands. The ship therefore able to send a wireless message to the Meteorologic Station at Calcutta giving approximately the position of the stor and the Station there is able to send telegram to Madras w information as to where the storm is, which direction it is movi in and whether it is a serious storm or not. All this informati Calcutta gets by wireless from ships in the Bay and passes on Madras. Therefore, long before the storm reaches Madras, t Harbour Authorities here know about it and are able to take p cautions against high winds, heavy rain and rough sea. Carg

are carefully protected, cranes and railway wagons are fastened down securely and all small craft are moved into the protection of the Boat Basin.

There is a great contrast between the Port of Madras before the harbour was built and the Port as it is to-day, when one of these cyclonic storms is in action. Fifty years ago there was no protection whatever in the Madras roadstead and, if any ship remained near the shore, it was likely to become a wreck should a cyclone blow up. So, when there were indications of cyclonic weather, though in those days there was no wireless to give exact information, all ships went away from the coast and out to sea. Now-a-days ships can lie throughout a cyclone in the harbour and they usually do so. But old customs die hard and even to-day some ships, when there is a storm coming, leave the harbour and go to sea. There is, we may admit, some sense in this because, although the harbour may protect the ships to a very large extent, it is not a comfortable place when a cyclone is blowing and ships cannot work their cargoes without great danger of damaging them; so it is reasonable that ships should, so far as possible, avoid this port during a cyclone. But the difference I wish to emphasise between ports on this coast and those on the west coast of India is that, while ships on this coast can avoid bad weather, those on the west cannot do so because the bad weather of the south-west monsoon lasts for several weeks, and there is no avoiding it.

Further, I want to emphasise the difference between a harbour in old days and a modern port. In old days ships looked to harbours for protection against storms but they need not trouble as a rule to do this now. A modern port is not essentially a harbour of refuge from weather but it is essentially a place where cargo can be moved between ship and shore easily, quickly and without undue damage. The history of the Port of Madras is the story of the development, not so much of a harbour in the oldfashioned sense, where small ships may run for shelter in sudden storms, as of a modern port, a centre of trade with easy communications to the surrounding country and up-to-date equipment and facilities.

Madras Future.—We have looked at Madras Past, her origin and growth; we have considered Madras Present, her position on the Indian Ocean and her trade. What of Madras Future? It is one thing to make assertions about the past and the present. What we say can be based on evidence. It is quite another thing to make assertions about the future, for these cannot be based on actual evidence and proved facts but only on conclusions and

opinions. Therefore, if you find yourselves unable to agree with my conclusions as to the future of Madras, I do not mind at all. In any case you, being young men, will see much more of the future than I shall; the future belongs to you. But my conclusion, based on the past history of Madras and her present standing, is that her future depends upon her trade, specially her overseas trade.

I must remind you again, Madras has not very great geographical advantages. It enjoys fine weather most of the year without heavy rain or violent storms and it is centrally situated in the Presidency and has easy access to the great States of Mysore and Hyderabad. But it has only a small harbour; no very rich country lies behind it; no great natural mineral wealth has been discovered in the rocks or soil. Her one claim to future greatness lies in her trade. The harbour has been built by man; the railways and great highways converging on the City have been laid by man; and all has been done in the interest of trade. Madras is at present the great distributing point of merchandise for Southern India, and this she owes very largely to her overseas trade. For the larger part of the big shops and mercantile business of the Presidency is in the City of Madras. It is true Madras has also become the centre of Government, of education, of culture and of social life of Southern India, but she would soon cease to be the centre if she lost her trade. Her industries would disappear, her wealth decline and grass would grow in the streets. Therefore we must preserve our port and foster our overseas trade, for without them Madras would soon disappear into the back pages of Indian history.

The Industries of Madras

BY

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The City of Madras has been growing on residential rather than on industrial lines and her industries, such as they are, reflect largely this aspect of city life and serve to meet what are predominantly local needs. Much of the city's importance arises from its being a capital town and in recent years it has tended to draw a large number of residents who have chosen to settle down permanently in the city on account of the amenities it provides in the form of educational institutions, amusements, etc. Although within the Presidency it always occupied the first place among the port towns, it had no natural harbour and only the expenditure of immense sums of money has created a safe harbour whose success from the financial point of view depends on the volume of the export and import trade which passes through it. The development of the Cochin harbour has to some extent undermined its dominance, but there is no reason to fear that it will at any time become a port of mere secondary importance.

Just as a country's exports give a clue to the nature of its industries, so also a city's exports will enable one to understand its industrial importance. Judged by the nature of her export trade which consists predominantly of raw materials and foodstuffs, the city has no fundamental or even major industries to boast of. The absence of coal and iron in close proximity to it or even within the Presidency has imposed a permanent handicap on its industrial expansion, which all the recent developments of hydro-electric power in various parts of the Presidency have done nothing to remove. The city's industrial power is still unduly costly and while it may be expected that in the years to come Madras too will be connected with the proposed electric grid system, that time is not yet come. In the meanwhile certain other centres like Coimbatore, Mettur and Madura are forging ahead and ousting Madras from its pride of place as the foremost industrial city.

Industries, organised or unorganised, which are special to Madras and which do not arise from the necessity of supplying merely local needs are the cotton textiles, handloom weaving, tanneries,

bidi-making, matches, aluminium and one or two others. A review of these industries will show that they are by no means either large in scale or of basic importance, although in regard to tanneries, Madras occupies a very important place.

Cotton mills.—Considering the fact that the textile industry was a long established one and that the two surviving mills were established over 70 years ago, the industry has had an arrested development. The number of mills in 1911 was 4, in 1921 it became three and now with the closing down of one of the mills there are only two left which are in the hands of one industrial company. The number of workers employed in these two mills, the Buckingham and Carnatic Mills is over 11,000, mostly men and boys. No woman is employed in factory work. The labour for the mills is recruited locally and during the last 15 years almost entirely from their own mill school where boys of the mill workers are trained and taken on to the factories as vacancies occur. In this respect Madras differs greatly from Bombay or Calcutta where labour comes from long distances, is migratory and constantly changing. In Madras on the contrary the labour force is local, stable and permanent. Apart from the special steps taken by the textile mills to get a stable labour population, the main reason for its stability and permanence is that the needs of the textile industry can be more than met by the available industrial population within the city.

Perhaps the main factor explaining the lack of any expansion of the city's cotton mill industry is that compared to certain other centres in the Province, Madras had no special advantages of location. Coimbatore and Madura are nearer the regions of raw cotton and also the consuming markets. It is only if an industry has an export market its location at a port town will confer on it any comparative advantage. More recently however the expansion of Coimbatore and other centres has to be explained by the superior access to cheap electric power which those regions have come to enjoy. Still although judged by the number of mills, Madras is very poor, the output and quality of the goods turned out at these two mills have won for them a very pre-eminent position in the country, and the cotton goods sent out from these mills have a very wide market all over India.

Handloom Weaving.—Although power using cotton mills are few in the city, Madras exports through its port a large quantity of hand woven goods of special kinds known by the trade name of Madras Handkerchiefs and Lungis which in 1937-38 was valued at Rs. 119.82 lakhs. In 1924-2

the total trade amounted to 255 lakhs but since then there was a great decline. Not all is manufactured within the city. The bulk come from inland centres. Out of about 40,000 looms engaged in the manufacture of Handkerchiefs and Lungis, about 9,000 alone are estimated to be in and around Madras city. The weavers are skilled men with knowledge handed down from generation to generation but are entirely in the grips of the capitalist middlemen who supply them with materials and market the goods. Whereas here the markets are overseas and the materials or fabrics expensive the independent weaver disappears altogether as he does not command credit or organisation for the purchase of materials and for marketing his wares in distant markets. The lungis and kailies are exported to Strait Settlements, Ceylon, F.M.S., Java, Sumatra, Burma; etc. Madras Handkerchiefs are chiefly produced in districts around Madras, viz., Chingleput, Nellore and Chittore. The trade is in the hands of half a dozen exporting firms in Madras who operate through their Dubashes or contractors who arrange from the supplies. These latter in their turn deal with middlemen contractors who are either capitalist weavers or the local cloth or yarn dealer. The weavers belong mostly to the Devanga and Baliga communities.

Tanneries.—Tanned hides and skins have been known to be one of the most important articles of export from Madras port for over 75 years. As long ago as 1875 the value of tanned hides and skins exported was about Rs. 1¼ crores, while for the ten years before the War the annual average was about Rs. 4 crores divided equally between hides and skins. The export trade was subject to violent fluctuations after the war. The Madras trade in tanned hides came down from Rs. 6 crores in 1919-20 to less than a crore of rupees in 1921-3 owing to the post-war collapse in trade and went up again to 4 crores in 1927-8. Tanneries are distributed all over the Presidency, but Madras city is the centre of the largest group of tanneries numbering about 200 of various sizes. The biggest among them, not only in India but in the East, which manufactures finished leather goods, is the leather factory at Chromepet managed by Messrs. Parry & Co., whose founder Thomas Parry was also the first to start a tannery on improved lines. The old indigenous method of tanning was improved upon by one De Susa of Pondicherry who used myrobalans as the tanning material. The large number of livestock in the province, the availability of the cheap tanning material, the skill of the tanners and the facilities for export were responsible for the growth of tanneries in Madras. Although tanning is not permitted within the city itself, its outskirts and surrounding villages contain a number of tanneries. In the north near the coast, Thangal

and Tiruvottiyur have a large number engaged in skin tanning and it is in this region that all the fresh skins from the Madras slaughter houses are tanned. At Madavaram and Sembiem on the north trunk road there are also a considerable number where both hides and skins are tanned. At Kodambakam on the S.I.R. line a number of tanneries exist which are engaged chiefly in the tanning of hides, although a few of them also do skins. Further along this line and on the south trunk road over a hundred tanneries working both hides and skins are located at Pallavaram, Chromepet and Meenambakam. Altogether these tanneries employ about 5,000 workers. Almost all are owned by Muhammadans but the workers are predominantly Hindus—chiefly Chakkiliars, while a few are Christians.

To the Department of Industries, Madras, belongs the credit of having proved the success of chrome tanning and after its successful experiments the tannery at Sembiam was handed over to a private capitalist. The chrome leather industry is now firmly established in this Presidency.

Aluminium Factory.—There is one aluminium factory working in Triplicane known as the Indian Aluminium Company making aluminium vessels. It obtains its raw materials from England and Belgium. The manufacture of aluminium vessels was first experimented upon in 1908 by the School of Arts, Madras. From the outset there was a good demand from the Military authorities and from Europeans for aluminium vessels and by establishing agents and subsidiary workshops at various places the Indian demand was also stimulated. In 1900 the Indian Aluminium Company was formed which worked in conjunction with the Department of Industries; in 1903 the Company took over the entire plant, etc. The only major advantage which Madras city possesses in regard to the making of aluminium vessels is that of market. No other company has since come into existence.

Bidi Industry.—Madras city takes a prominent place in the manufacture of what are called bidies, which are tobacco dust rolled into a cigarette-like thing on thumbi leaves. The leaves for rolling come from Hyderabad and the dust from Surat and Belgaum. Although the industry is carried on in several other parts of the Presidency, Madras has a preponderant share. The industry seems to be founded entirely on cheap boy labour and owes its continued expansion to that factor. In the city large numbers of poverty-stricken workers live who are willing to let their children be employed at miserable wages for long hours. No adult worker can hope to earn a living wage even by working 12 hours. It is also the case that

parents pledge the labour of their children in return for a certain sum of money paid to them. The industry is truly parasitic one of which the city has no reason to be proud.

The industry is in the hands of a few big capitalists who purchase the tobacco and the leaves and distribute them among the large number of bidi-makers scattered over the city but somewhat concentrated in Triplicane and Washermanpet. They work through middlemen who actually employ the workers, pay their wages and control the conditions of work. The bidies are taken to the capitalists who pay them by the piece. Bidies have a wide market in India and are also exported. There are over 1,000 little bidi makers in the city. The workplaces are insanitary and congested and the accommodation insufficient for work to be carried on comfortably. The industry is left entirely uncontrolled and it is time that some kind of control is exercised over it.

Match factories.—Only in recent years did Madras city start three organised match factories although the consumption of matches in the province is very large. The biggest factory is that of the Western India match factory at Tiruvottiyur employing about 800 workers and turning out an output of about 1½ million boxes a day. The other two factories are located at Tondiarpet and at Washermanpet. The veneers for splints and boxes are got from Palghat and the remaining processes are carried on in the factories.

Pencils and Glass.—Besides the above there is a pencil factory which was first established by Government and later handed over to a private company. On the outbreak of the war some pencil making plants which had been abandoned were taken over by the Department and pencil manufacture was resuscitated in 1915. The services of an expert were secured and the pencils were so satisfactory that an annual sale of 84,000 dozens were effected in 1919. The factory now employs 50 workers and supplies pencils of various kinds to Government departments. There is also a glass factory at Tondiarpet started by a glassware merchant. The availability of good sand at the place and the cheapness of site were responsible for its location and the factory turns out glass chimneys, domes, and other ware. It employs about 100 persons daily and its output is valued at Rs. 72,000. A drug factory at Vepery manufacturing tinctures, drugs and other chemicals and employing about 50 persons completes the list of these miscellaneous industries.

It will be seen from the above that Madras cannot claim to possess any large number or variety of industries which are in any sense special to it. Its most distinctive industries are tanning, hand-

loom Handkerchiefs and Lungis, and bidi-making. The tanneries are located outside the city and although Handkerchiefs and Lungis are handled in the city for export to other countries, the actual work of weaving is carried on in surrounding districts as well as elsewhere. Its most dominant industry, *i.e.*, the bidi industry, is an unhealthy trade in every sense of the term. It will however be a serious misconception to conclude that the city has therefore no considerable industrial activities to its credit. On the contrary, the city is making rapid strides in the extension of its activities in various directions. What is significant and gives the key to a proper understanding of the subject is that the kind of industries which predominate in the city are those designed to meet the local needs of a growing population whose consumption of goods of various kinds is markedly increasing. Each large city has thus its own local industries but in Madras these are far and away the most important.

What are the predominantly local needs of a city population ? They are food, well-drained, lighted and ventilated houses, furniture, clothing, amusements of various kinds, books and newspapers, transport facilities to enable people to go to and return from their places of work and a few others. Corresponding to the above we have in the city bakeries (but in view of the city's consumption of rice, not many), hotels and restaurants, brick industry and house-building industry, furniture trade, a few clothing mills but a large number of tailors and laundries, shaving saloons, printing presses, film industry and picture houses, road and rail transport industry with their numerous workshops, electric industry and others. The city employs a large number in trade and distribution of goods of various kinds to the citizens. Some idea of the way in which the people get their living may be seen from the fact that out of about 1 lakh of earners in occupations in the city

12,000 are employed in hotels and trade in foodstuffs
12,000 in domestic service
7,000 in cotton spinning and weaving.
5,000 as limeburners and masons
5,000 as carpenters
5,000 as printers.
5,000 as jewellery makers
4,000 as tailors
2,000 as barbers
1,500 in electrical works
3,000 as private motor drivers

4,000 as bidi makers
8,000 in bus and rail transport
2,000 as blacksmiths

and a large number, about 25,000 as general labourers. The list does not include clerks, professions, etc. Besides the above there are large numbers employed in laundries, garages, repair shops, furniture trade, etc.

Few of the above trades can be said to be either large or organised. Of those which employ about 20 workers and engage power, the most important are the various workshops and printing presses.

Workshops.—No modern city can be without its own engineering workshops, electric and mechanic. The M. & S. M. Ry. has the biggest workshop at Perambur, employing over 7,500 workers. Besides the Perambur workshop, there are others in the city of which the most important are (1) the P.W.D. workshop, Royapuram, (2) Madras Port Trust Workshop, Harbour, (3) the Corporation Workshop, (4) Massey's, (5) Crompton's, (6) Union Car's, (7) Simpson's, (8) Addison's, (9) Beehive Foundry, (10) Binny's. All kinds of mechanical and electric work are undertaken in these shops and they are a necessary adjunct to the transport industry.

Printing Presses.—There are about 60 presses distributed throughout the city; but the bigger ones numbering 12 are mainly in Mount Road and George Town. The total number employed in the presses is about 6,000. The largest presses are the Government Press, the M. & S. M. Ry. Press, the Addison Press, the Premier Press, the Associated Printers, the Hindu and the Madras Mail.

Tailoring.—Tailoring and dressmaking employ a large number of workers in the city. According to the census of 1931 there were about 4,000 tailors who are distributed all over the city but are predominantly found in Triplicane and George Town. The fact that they are near colleges and residential centres and the further fact that most of the shops where cloth is sold are located in George Town explain the location of the tailoring industry. It is estimated that there are about 600 to 700 tailoring shops in the city but 50% of them are small ones containing less than 3 workers including the master tailor. The bigger shops containing over 10 workers are few in number, probably not more than about 20. Unlike as in England there are very few cases where the tailors themselves own cloth-shops as adjunct to their business.

The Muhammadans form more than half of the proprietors of the tailoring shops: next come the Mahrattis and then Mudaliars. A few Brahmins have also taken to tailoring. Although children are employed in tailoring, they are taken as apprentices and there is no exploitation of child labour here as in bidi shops. The only serious problem in tailoring trade is under-employment and unemployment. Work is available only for 3 or 4 days in the week and consequently the earnings—though not the wage rate—are very low.

Metal industries.—Park Town, Tiruvateesvaranpet and Triplicane are important centres of domestic brass and copper vessels. The workers are mostly Kannars numbering about 150 to 200. They are supplied with sheet metal by dealers and are paid by the piece. There are also two factories employing power which manufacture patented brass cookers and other vessels, viz., the Rukmini Cooker factory and the Kerala Cooker factory.

Steel Trunks, locks, hinges, iron safes.—These give employment to a considerable number of workers. They are made predominantly in Mannadi, Washermanpet and Wall Tax Road. Nearly a thousand workmen are engaged in the making of these goods. They do their work to the orders of the middlemen-traders who supply the materials and take the finished goods.

Jewellers and goldsmiths.—A prosperous city must have its own jewellery shops where the workmen belonging to the *asari* caste work either independently or at the direction of capitalists. These little shops are distributed all over the city, although the bulk of them are in China Bazaar and Mint Street. The owners are mostly Marwadis and Komatis who supply the material to the workers and take back the worked articles on payment of wages by piece. It is estimated that there are about 400 to 500 workers living in this way; but the high price of gold has recently caused a serious decline in the volume of their business.

Wood and Rattan Work and Furniture shops.—There are over 4,000 carpenters and wood workers who make doors, windows, furniture, etc., and work under contractors. Many of the furniture firms are located in Rattan bazaar, Mount Road and Mannadi and do a fairly prosperous business. As the people's standard of living increases, the demand for furniture also increases. Another industry which also is likely to expand its activities is the sandal-making and shoe-making business. Although Madras is very unlike a northern India city in that most of its citizens walk bare-

footed; there has been a definite change of fashion in this matter in recent years and the increasing number of shoe-makers in the city bears testimony to the shift in demand.

It is not necessary to refer in detail to the host of miscellaneous little trades and industries of which Madras like every other city abounds. Madras gets its fuel of casuarina wood from Chingleput District along the Buckingham Canal and employs a large number in transporting the firewood from the surrounding areas to the city. Similarly the large coast-line of the city gives employment to a number of fishermen who earn their livelihood by fishing. The recent expansion of activity in house-building has led to a number of little brick works at Aminjikarai and other places where the availability of suitable clay has attracted the industry and the allied industry of lime-burning, pottery, etc. The city has a large and growing number of cinemas and theatres and the number of film producing companies is on the increase. The increase in the number employed as motor drivers, conductors and inspectors points to the growing of road-transport within the city.

Conclusion. From the foregoing, it will be observed that Madras has few special industries of note. Its export trade reveals little of manufacturing activities. Even the large export of Madras handkerchiefs and lungis from Madras Port is of goods manufactured predominantly in other districts than Madras. Tanning of hides and skins is the only industry of note, although even here it is more a collecting and exporting region rather than a producing region. Most of her industries serve only local needs and arise out of the necessity of having to supply the needs of a vast city population, which in 1941 may reach 750,000. The industries are generally speaking small and are widely scattered. Land values are not after all so forbiddingly high as to compel a factory to shift to the outskirts. Further the workshops which are the largest factories have necessarily to be located within the city, as distance away from the city will be a serious handicap. The smaller establishments have perhaps even greater chance of success than the bigger ones, as in most cases they are able to take advantage of local conditions and are sometimes free from taxes and other burdens than the bigger ones.

The industrial importance of Madras can grow only when its present handicap arising from costly fuel is removed by the introduction of cheap hydro-electric power. Even then it is doubtful if it will be able to develop many of the basic industries as apart from power they require productive factors in the shape of capital, and business ability which are, by no means, superabundant.

Fruit Supplies of Madras

By

H. G. Punja, M.A., Dip. Econ.

Madras with its vast population of 6½ lakhs consumes a large quantity of fruits ; but up-to-date and reliable statistics in regard to the supply of fruits to the city are not available. A rough idea of the quantity imported can, however, be had from the following figures. In the months of December 1934 and May 1935, Madras *imported the following quantities of fruits.*

Name of fruit.	Quantity imported in December 1934.	Quantity imported in May 1935.
Apples.	2,851 cases.	—
Kamala oranges.	8 047 baskets.	3,694 baskets.
Sathgudi and other *tight-skinned oranges.*	7,751 „	283 „
Grapes.	959 pots.	565 pots.
Sapota.	46 bags.	202 bags.
Custard apples.	88 baskets.	—
Pomegranates.	454 „	—
Mangoes.	—	52,538 baskets + 4 wagon loads.
Musumbi and figs.		286 baskets.

But the above figures cannot be taken to represent the entire imports of fruits in those two months for they do not include the import of plaintains and the fruits supplied by lorries and bullock carts. As there has been an increasing supply of fruits by lorries in recent years the above figures cannot give an accurate idea of the present supply. The entire orange supplies of 1934-35 are estimated at 83,760 maunds consisting of 37,360 maunds of Kamala oranges, 35,000 maunds of Sathgudi, 7,000 maunds of Batavian, 4,000 maunds of Salem oranges and 400 maunds of African oranges.

It is estimated that Madras now consumes annually about 300,000 maunds of plantains, 100,000 maunds of oranges, 4,500 maunds of grapes and 4000 maunds of apples. In regard to mangoes, which ranks next in importance to plantains no estimate appears to be possible, for in addition to imports by rail, we receive large supplies by lorries, bullock carts and in head loads. Besides almost all the gardens within the city have a considerable number of

mango trees. The quantity imported and consumed within the city of Madras is considerable as may be inferred from the quantity supplied by rail in the month of May 1935. In addition to the above mentioned fruits we receive several other fruits in varying quantities.

Madras is by far the largest fruit consuming centre in the presidency. Fruits from distant overseas countries, as for instance California in the United States of America, S. Africa, Japan and Australia are imported into the city. In regard to home-grown fruits, even places in remote corners of India such as Quetta, Chaman and Kashmir supply fruits to Madras. But the bulk of the supply comes from places within the Presidency. Thus we get our supply of fruits from all over the world; high grade fruits like apples grown in distant countries down to wood apples (Vilam palam) grown in the gardens of Madras can be found in the Madras market.

Of the fruits that are universally consumed in Madras, plantain is the most important. It is found here in abundance all through the year. It is one of the cheap fruits within reach of the poor class of consumers. In regard to this fruit the Madras market is supplied by places served by the South Indian Railway, mainly Cuddalore in the South Arcot district, Tiruvadamarudur in the Tanjore District, Karur in Trichinopoly, Dindigal in Madura, places round about Namakal in the Salem district and Coimbatore. In addition we receive supplies of Nendram plantains from the Malabar district.

Mango ranks next in importance to plantains. We have a very large average under mangoes in this Presidency. Of the total acreage of 7.5 lakhs under fruits and vegetables an acreage of nearly 2.5 lakhs is under mangoes alone. We receive large supplies of this fruit from all over the Presidency, but the bulk of the supply comes from the neighbouring districts of N. Arcot, Chittoor, Salem, Cuddapah and Chingleput. The most important consigning centres are Tirupattur, Vaniyambadi, Jalarpet, Gudiyattam, Vellore, Pudi Puttur, Tiruttani, Chittoor, Nagari, Chinnapatnam, Krishnagiri, Salem, Dharmapuri, Kuppam, Rajampet, Oorambadu, Koduru, Nandalur, Sittigunta and Ponnampet. Madras receives some of the finest variety of mangoes from the Northern Circars. From outside the Presidency we receive our supplies of mangoes from Mysore.

Mango has a short season of four to five months in summer. This fruit comes to the market when the supply of other fruits is

not plentiful. As the Madras market receives its supply from all over the Presidency, we have this fruit in our market from April to September and at times in October too. This is because we get our supply from places having an early crop as for instance Malabar and also from places having a late crop. It is not uncommon to find small supplies of mangoes in the Madras market even in November and December. These come from places enjoying a second crop, for instance, Tinnevelly. We get the heaviest consignments of mangoes between the middle of May and middle of June.

Citrus fruits (Loose jacket or Kamala oranges).—Madras consumes oranges to the extent of 100,000 railway maunds annually. Of the various varieties imported into the city the loose-jacket or the Kamala orange ranks first. This contributes nearly 45 per cent to the total supply of oranges. The biggest source of Kamala orange is Nagpur in the Central Provinces. The Northern Circars rank next in importance. From about October to January we receive fairly large consignments of oranges from Anakapalle, Narsapatam and Rajahmundry. During this season Nagpur also sends fairly large consignments. Of the 8000 baskets received in December 1934, about 4500 baskets were from Nagpur and the rest from the Circars.

There are three distinct seasons for the Nagpur oranges. The first season is what is known as *Hati-bahar*, which lasts for a short period from June to July. We receive very small consignments during this season in the Madras market. The second season is the *Ambi-bahar* which lasts for about four months from about October to January. On certain days during the season consignments of nearly thousand baskets arrive in the Madras market. The third season is the *Mrig-bahar* and it is the most important season lasting for about three months from February to May. We receive large supplies of oranges during this season. A daily supply of 3 to 4 wagons, each wagon containing 120 to 160 maunds is not uncommon during the height of the season.

Tight-skinned oranges (Sathgudi, Batavian, Musumbi and sour oranges).—The Sathgudi is the most important of this class of fruits and is the most popular with the Madras people. There has been an ever-increasing demand for this fruit in Madras. Sathgudi can be found in our market practically all through the year except in April and May. The bulk of the supply comes from Cuddapah, Chittoor and North Arcot districts. There are two seasons for the Sathgudi oranges, the *angam* and the *gyrangam*. The main season is the *angam* which lasts for about eight months

from August to March. It is during this season that we get heavy supplies. The peak consignment comes in some-time after the middle of September and before the middle of October. The second season, the *gyrangam* is a short one and lasts for about three months from June to August. Thus we continue to get Sathgudi oranges from June right up to March, with an upward trend till about the middle of October, and a gradual decline thereafter.

During the rush of the Sathgudi season *i.e.*, from September to December, the supply of other tight-skinned oranges is very limited. The quality of these fruits in comparison with Sathgudi is inferior and there is therefore, very little demand for them during this season. Consequently the price obtainable for these fruits in that season would hardly meet the cost of transportation. In the off and slack Sathgudi season we get these fruits. Of these the Musumbi comes from Poona (Bombay presidency), the Batavian from the Circars and the sour oranges from Salem. These fruits find a ready sale in the off-Sathgudi season. The sour oranges because of their poor quality and low price find a sale among the poorer class of buyers. At times unscrupulous vendors sell these as Sathgudi.

Among the other fruits that are imported but not in such considerable quantities are apples, grapes, melons, pineapples, sapotas, custard apples, pomegranates, plums, papayas, peaches, grape-fruits, pears, guavas and jack-fruits. Fruits like apples, pears, peaches, grapes and grape-fruits require special climatic conditions for their culture. They are, therefore, rare and too costly to enable even the richer class of people to go in for them. Cheap fruits like custard-apples and guavas are not popular with the Madras public. Of the costlier fruits the apple is the most important. The supply of this fruit to the Madras market is estimated at about 4000 railway maunds. It is a fruit grown in the temperate regions. As Madras grows very little of this fruit, it is but natural that we do not have a plentiful supply of them. All the same, we find apples in the Madras market all through the year. We import the bulk of our requirements in this line of fruits from foreign countries such as the United States of America, Japan, South Africa and Australia. We also get some supply of apples from Kulu in the Punjab, Kashmir, Bangalore and the Nilgiris. Out of 2851 cases received in December 1934, 2100 cases came from the United States, 600 cases from Japan, while only 151 cases came from Kashmir. Apples from South Africa and Australia (countries of

the Southern hemisphere) arrive in the Madras market during summer months, when there is less competition from other sources.

Grapes.—These fruits are imported into the city from Chaman, Quetta, Krishnagiri, Kodaikanal and Bangalore. The quantity imported from Northern India is estimated at about 4000 maunds. But on account of the high transportation costs there appears to be a decline in imports from Northern India. We receive a small supply of this fruit from Australia as well. By far the best variety comes from Chaman and Quetta and we get the bulk of the supply during September and October. Grapes received from within the Presidency are not of such good quality as those received from Chaman and Quetta.

In addition to the fruits mentioned above. Madras gets supplies of melons, pomegranates, pineapples, plume, pomeloes, sapotas, custard-apples, figs, pears and papayas, jack-fruits and guavas in varying quantities. Cuddapah supplies melons from January to March. Pomegranates are imported from Coimbatore, Madura, and Chaman; sapotas from Samalkota, Pithapuram, Anakapalli and Rajahmundry ; figs from Rajewadi (Bombay presidency); Custard-apples from Kuppam and Gudupalle ; pears from the Nilgiris; and plums from Mirzapur.

The bulk of the fruit supplies of Madras comes from within the Presidency. The fruits that are received from outside the Presidency are apples, grapes, Kamala oranges, figs and pomegranates. The quantity of fruits received from sources outside the Presidency is, however, comparatively small. The imports from outside continue either because of their scarcity within the Presidency or of the superior quality of certain fruits.

Madras is importing fruits in increasing quantities in recent years. Taking into account the vast population of the city, the quantity of fruits imported and consumed must be considered very low. The problem is not, however, one of inadequate supply, for if at all there is a demand, adequate supplies can be found to meet the increasing needs. The problem is one of prices. Under the existing level of prices, only the wealthy class of people can afford to purchase fruits. To the vast majority of the population fruit under the existing level of prices remains a luxury, and its purchase is limited to festive and ceremonial occasions. At other times the poor class of people buy fruits only when prices fall in the rush of the season. In order, therefore, that there may be greater demand for fruits the prices should be reduced consider-

ably from the present level. More efficient distribution and lowering of the cost of transportation might go a long way towards the reduction of the prices of fruits.

The question of transportation of fruits is one of the most important problems connected with the fruit trade and the Royal Commission on Agriculture lay particular emphasis on this question. No doubt, Madras is connected with a net work of railways and roads. But it cannot be said that we have an efficient means for the transportation of fruits. So long as the railway freight remains high and so long as we do not have a quick and efficient goods traffic, a proper distribution of the fruits cannot be facilitated. Under the existing conditions special reduced rates are allowed when a sender elects to send fruits at his own risk. This is the cheapest rate at which fruits can be consigned by rail. But under this system the railway administration cannot be " held responsible for any loss, destruction or deterioration or damage to the consignment from any cause whatever except upon proof that such loss, destruction etc., arose from misconduct of Railway administration's servants," and the burden of proving such misconduct on the part of railway servants rests with the consignors, though the administration is bound to disclose how the consignment was handled throughout the time it was in its possession. Such provisions in the rules account partly for careless handling of packages by company's servants, which is one of the prolific sources of deterioration of fruits. But when it is realised that even these reduced rates consume a good percentage of the prices paid by consumers, transportation of fruits like mangoes and plantains at rates other than reduced, should be considered to be almost impossible.

The problem of fruit transportation involves not only the question of freight but also the proper method of conveyance. In conveying fruits it is of the utmost importance that, as far as possible, the consignment should be transported in a single haul, without changing the consignment from one vehicle to another. Unloading and reloading of baskets often cause damage to fruits. But this is inevitable in certain journeys particularly when the gardens are far removed from the railway lines and also when the journey involves a change from metre gauge to broad gauge railways as for instance from Krishnagiri to Madras and from Chittoor to Madras. But in such cases where the distance to be covered is not great lorry transport can be substituted for railway transport. In fact some of the growers in Chittoor, North Arcot and Chingleput consign fruits to Madras direct by lorries. This not only

saves time, but also saves money, and, what is more, fruits reach the destination direct from the gardens with the least possible damage. Consequently, there has been an increasing volume of trade by lorries in recent years.

For a better and more adequate distribution of fruits among the citizens of Madras, it is necessary that the retail trade should be more evenly distributed at various centres of population. At present the whole-sale trade and much of retail business are concentrated in George Town. Outside George Town there are a few stalls dealing in many lines of fruits in Triplicane. In the Moore market the vegetable vendors deal in a few lines of fruits. With the exception of plantains, the other fruits reach the less wealthy class of people through hawkers who deal in a few lines of low grade fruits. The concentration of retail trade is certainly not conducive to the creation of a better demand for them, for, where there is a desire on the part of middle class buyers to go in for fruits, the absence of good fruits near at hand is a real handicap. It is quite possible, however, that the lack of adequate demand is responsible for the total absence of fruit stalls in certain centres of population. If that be the case an " Eat more fruit campaign " with facilities to purchase fruits at moderate prices without the necessity of spending money on conveyance might create a better demand for fruits.

On account of the extremely perishable nature of most of the fruits and their production at certain seasons only, the distribution of the supply is not uniform throughout the year. We have, except in the case of plantains, periods of heavy and short supplies. Taking for instance the case of the three important class of fruits viz., plantains, mangoes and oranges, the distribution of plantains is more or less uniform. We have mangoes only for a short period during the year and for about a month in May and June we have such plentiful supplies that the prices obtainable for certain varieties of this fruit do not even defray the cost of their transportation. In regard to oranges the distribution is more satisfactory, yet we have scarcity in the months of May, June and July, while we have a glut in October, February and March. It is in the interest of both growers and consumers that we should minimise this maldistribution as far as possible.

Other fruit producing countries of the world have sought to prevent maldistribution by providing cold storage facilities and by diverting the excess supplies during periods of heavy output to

canning, preparation of jams jellies, syrups and beverages. Gluts in the Madras market can be avoided to some extent by providing cold storage facilities. At present the ice factories of Madras provide limited accommodation for storage of fruits. Only high grade and costly varieties of fruits such as apples and grapes are kept in cold storage at present. But with the completion of the Patel cold storage, which is now under construction, better facilities and larger accommodation will be available in future years.

Madras, situated as it is within easy reach of some of the most important fruit-growing districts of the Presidency viz., Cuddapah, Chittoor, North Arcot, Salem, Trichinopoly and Madura, can rely on a plentiful supply of some varieties of fruits. With better facilities for railway transport and reduction of the freight, Madras can provide a market for some good varieties of fruits from the Circars. Greater demand, however, means more reasonable prices. Less of the profit-seeking motive on the part of growers and those engaged in the trade, a more efficient system of distribution and an understanding on the part of consumers of the value of fruit as an article of diet can create a considerably larger demand for fruits.

Fisheries of Madras

By

Mrs. P. S. Sundara Raj, M.R.S.T., F.R.G.S.

One of the prettiest sights in Madras is to see the fishermen silhouetted in early dawn against the placid waters of the Adyar River, or the fleet of tiny sails returning at evening to the beach. For the Madras fishermen pursue their calling with the age-old methods of their ancestors from the dawn of history. There are two groups of fishermen in Madras, who are quite distinct. The inland fishermen confine themselves to the rivers and backwaters, and never go to sea, while the sea fishermen, though by long custom generally restricted to the ocean fisheries, occasionally bring their big nets into the Adyar, thus stealing a march over the more conservative freshwater fishermen.

The city of Madras includes the lower course of both the Cooum and the Adyar Rivers, the latter forming the Southern boundary of the Municipality. Both rivers are now closed at their mouths by sand bars for the greater part of the year. The water is brackish, except when flood-waters are brought down during heavy rains. The Adyar forms a backwater near its mouth, about a square mile in extent. The Cooum is little more than a tidal creek, though like the Adyar, it will contain a good deal of fresh water during the monsoon. The two rivers are connected by the Buckingham Canal, which has been cut parallel to the sea, crossing both the Cooum and Adyar rivers. In the summer months there is practically no flow in the rivers and so there is a considerable influx of sea water. As the sand banks or 'bars' are raised by the action of the breakers, the effect of the tide becomes gradually less, but a certain amount of percolation from the sea continues through the sand banks. With the coming of the monsoon the bars are opened again and fresh water flows out to sea. During the hot weather the Adyar becomes a series of pools and mud flats, the greatest depth being about six feet in the channel which extends about a mile from the sea. The result is that the fauna of these connected waters show a predominantly marine character. Fifty-four species of fish have been identified, but of these only seven are fresh water forms. A few come in as migrants from the sea, but most appear to be permanent inhabitants of the backwaters and pools. Some of the marine fish, such as white-

bait, barracuda, rockcod, snappers, perches, spade fishes, horse mackerel and flat fish (Pseudorhombus javanicus) have been caught, but only when the bar is open and the salinity high. Of the fresh-water species, etroplus, catfish, minnows (Aplochilus and Panchax) and the tiny carps (barbus spp.) are common, but these can all probably breed in brackish water. It is almost universally accepted that all our fresh-water animals are the descendants of ancient marine animals which have learnt to adapt themselves to life in a different medium. This process seems to be more accentuated in the Tropics, and a relatively small area, such as is comprised in the connected water system of the Cooum and Adyar, spreading as it does into salt marshes and backwaters, with freshes and tides, deep pools and almost desiccated mud flats, and a corresponding high range of temperature, provides a remarkably interesting field of study. Here the animals of the sea, backwater and fresh water can be observed in association, adapting themselves for life in a common medium. Of course many changes are required before a marine animal can fully adapt itself to life in purely fresh water, but among the brackish water fauna of the Adyar River some of the most important morphological adaptations can easily be observed. For instance, most brackish water animals have special mucus secreting devices which prevent the passage of water in or out for a certain period, thus guarding against sudden changes in salinity. In addition, if exposed to the danger of desiccation, the presence of mucus would no doubt be a great protection. The water snails (Gastropods) of Adyar are without exception capable of copious mucus secretion. Again, not only is the oxygen content low in shallow brackish water, but there is also the danger of the almost complete drying up of the water. In the Adyar the amphibious element predominates, many species inhabiting the marginal zone or the water edge. Crabs and fishes specially have developed extensive means of aerial respiration. The quaint little mud skipper (Periophalmus and Boleophalmus spp) are fish which seem to prefer being outside the water, though they can swim, while some of the crabs have so adapted themselves to a life on land that they die if submerged for any length of time. Some of the hermit crabs (Clibanarius) cannot thrive under water for long periods. Such animals have to remain at the water's edge when changes in level take place by tidal action Again some areas become almost completely dried up, and for the amphibious and attached animals particularly the problem is a serious one. Some of the crabs (e.g. Sesarma) burrow deeper and may be said to aestivate. Others migrate to the river bank from the back-

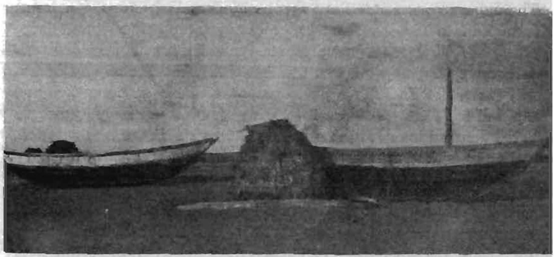
waters as they dry up. The anemones will survive so long as there is the slightest amount of moisture. Another noticeable feature of the fauna of this area is the high rate of reproduction. Apparently many species are able to breed all the year round, and whenever environmental conditions are favourable, a high rate of reproduction takes place, with, in addition, a tendency for early sexual maturity and rapid development.

THE FISHERMAN AND HIS CATAMARAM.

The fish obtained from these areas are of course very small and low-priced, but they are eagerly bought by the poorer people. The bulk of the fish found in the Madras markets is sea fish. Of the fifty-three kinds generally found, only a few, such as seer, pomfret, hilsa, Indian salmon, prawns and crabs, and a few others are considered prime fish and fetch good prices. Yet these are not the economically important fish, although they are of prime quality and the supply is never sufficient. The low-priced small fish, such as silver-bellies, are bought eagerly by the poor, and they more than make up in quantity for the relatively small amount of prime fish which is sold.

The river fishermen use hand nets, stakes and traps of various kinds, and small catamarams. The life of a catamaram is short. Though it is a mere bundle of logs, it is costly to buy, since it is made from a particularly light wood found only in Ceylon. Some intrepid fishermen make the long voyage regularly on these crazy

craft in order to bring back fresh logs for making catamarams. The ravages of seawater and insects soon show themselves and when the logs have been reduced in size by shaving off the spoiled outside portion, the catamaram is useful only in the river or backwater. A few fishermen use rods and handlines. The sea fishermen, on the other hand, in addition to the catamaram, use the Masulah boat, a remarkably seaworthy boat built of planks sewn together. These boats will ride the heavy surf and until the construction of the harbour, were the only means of communication between large vessels and the shore. These Masulah boats are used to operate the biggest nets. Other nets are worked from two or four catamarams, and there is a special catamaram built of



THE MASULAH BOAT.

seven logs instead of the usual three to five, which is used for working big nets and for going long distances out to sea. A special catamaram is used for catching flying-fish. Thus, although the Madras fisherman uses the methods of his remote ancestors, various types of craft and nets have been evolved to meet different requirements, and within his limits the fisherman is as skilful and successful as the fisherman of any other country with more elaborate appliances.

Fish arrives in the Madras markets from many sources. A good deal is landed at various points on the beach. The local estuarine and backwater fishermen frequently sell in small quantities near the place of capture. Other sea fish is brought by rail, motor bus, lorry, jutka, boat and head load from Pulicat, Sadras, Ennur and other adjacent fishing villages, and occasionally in ice

from as far away as Malabar. Good fresh-water fish has occasionally come from the big tanks at Sembarambakkam and Sholavaram, and the more distant reservoirs at Mopad and Mettur.

It is perhaps surprising to discover that the average price for fish paid in Madras compares favourably with that obtained in Western countries where the standard of living is so much higher and the trade and industry thoroughly organised. Prices fluctuate considerably, owing to the lack of facilities for storage and distribution. If a good catch is obtained on a day when fish-eating Hindus observe a fast, for example, prices will fall heavily. On the other hand, a scarcity of fish on a festival day means very high prices. The amount of really good fish available is relatively small, and so commands a high price, since there is a real demand. The experiments carried out by the Madras Fisheries Department from 1927 to 1930 by the trawler "Lady Goschen" revealed large potential fishing grounds at present beyond the reach of the ordinary fisherman. But it would be useless to increase the supply of fish without a corresponding development of both preservation and rapid distribution. Even as it is, with the ordinary supply unequal to the demand much of the fish goes bad before it can be marketed, and on days of glut good food has to be wasted.

One of the most valuable discoveries of very recent date is the presence of vitamin A potency of a very high order in the liver oils of some of the sharks which abound in Indian waters, including of course the Madras coast. The research is by no means completed, but even with the crude methods of refining that are the only ones available at present, an oil has been found to be nearly three-fourths as valuable as halibut liver oil, the greatest known source of Vitamin A. Experiments with the oil as medicine have yielded amazing results, yet so little is its value known that hithero it has only been used as a cheap illuminant, and on the West coast for smearing boats,

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Geography from A Railway View-Point

BY

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A railway journey is a familiar experience to most of us, so familiar, sometimes, that it becomes just a means of reaching one's destination. Fortunately, this is not true of children; to them a train journey never fails to be an exciting affair. Much of their interest is in the ever-changing panorama which unfolds before them, to which the average adult is made blind by force of habit and a dulled imagination. To the geographer such journeys afford a most valuable means of "taking in" the meaning of the fleeting landscape and its changing character; a geological map is an invaluable companion for understanding the major features of the landscape. To the teacher of geography they provide most valuable occasions to "demonstrate in the field" all that he has been teaching in the class room. In the following account of the journey from Bangalore to Madras (which has been chosen because it is most familiar to the author), an attempt is made to show how he who runs may read.

* * * *

The railway journey from Bangalore to Madras takes one down from the plateau across the coastal plain and thus provides a contrast between the two as well as a cross-section of both. Bangalore is situated on the undulating plateau, and the landscape after leaving Bangalore is typical of much of the Mysore plateau.

Some of the house types and distributions to be seen along the railway till Bangalore East Station is passed, are representative of several parts of the town and also illustrate some of its history and associations. The bungalows and cottages strung along both sides of the railway line between the Cantonment and the East Stations form parts of the "extensions" of the Cantonment, which were made largely during the periods of prosperity immediately before and after the war. Many of the houses in the outlying extensions remain vacant during most of the year and are occupied only during the season, —April to July,—when visitors from all over South India and also from even farther away come to Bangalore, attracted by the cooler weather and the facilities for rest and recreation which it offers.

Fraser Town, which lies in the valley bottom, is one of the oldest "*extensions*"; it was formed in 1906 in order to relieve the congestion in the Cantonment, after the outbreak of plague in 1898. The original settlement in the valley was a small village called Papireddypalya, and the "extension" is also known alternatively by this old name. After the plague, it was decided to open out the congested area by means of such extensions and this led to the spreading of the population into the adjacent valleys. Bangalore was originally a group of valley-line settlements separated from one another by ridges which were sometimes cultivated. The British advent brought the first great change. The troops transferred from Seringapatam because of the unhealthiness of that place, were at first garrisoned in the fort, where the Europeans, officers and others, also lived. With the rendition of the State to the Mysore Royal Family, the area known as the Civil and Military Station was assigned to the British, who then moved out of the Fort into this area with their troops. It led to the occupation of the ridges by the military, and the construction of most of the military buildings, barracks, lines and offices, along them. The tops of the ridges were used as parade grounds, and this continues even now.

The next stage was the drifting of civilian population in the wake of the military, attracted by the possibilities of trade resulting from the presence of troops. These later arrivals occupied the intermediate zone, between the original valley-line settlements of the agricultural population and the military population along the ridge crests. The European and Anglo-Indian civilian population settled on the two ridges of the Cantonment,—in what are now called St. John's Hill and Shoolai,—at some distance from the native settlements, and the intervening gaps were filled up by the original valley settlements expanding up the slopes on both sides. The zoning of communities and house types in belts parallel to the ridge and valley-lines, and the location of the markets in the valley bottoms and the churches and European shops along the ridge crests, still preserve the original features.

Some of the newest extensions seen on both sides of the railway between the Bangalore East Station and the Imperial Tobacco Company's Factory, illustrate another feature of the people and the life of Bangalore, viz., its popularity as a place for retirement, mostly, among European and Anglo-Indian officials. This popularity is associated with the fact that there is already a large European and Anglo-Indian community in the place, perhaps one

of their largest groups in all India. They have here numerous excellent schools for the education of their children, and some of the parents whose children are being educated in them choose to make their homes in Bangalore.

Between the Bangalore East Station and the Tobacco Factory, on the left or north of the line, is a small rock outcrop, called Machal Betta, from the top of which a very fine panoramic view of the town and the surrounding country is obtained. The Tobacco Factory is unique in South India and enjoys much freedom and many facilities by virtue of its situation within the Civil and Military Station where there are no other factories of its size. Its location was probably determined by the suitable site available adjacent to the Railway line, and probably also by the laxity of state control which it has always enjoyed compared to the factories elsewhere in British India and in the Indian States. There is no other reasonable explanation for the location of the factory at Bangalore, for it gets most of its tobacco from quite distant places within as well as outside India, and likewise exports almost all its output to distant places.

Immediately after passing the Factory, there are the New Sappers' Lines on the right or south of the railway line. This area was taken over by the military only a few years ago and all the buildings seen there have been erected since then. This is explained by the need for evacuating the existing military areas in the "assigned tract" of the Civil and Military Station, which will be retroceded to the Mysore State. The military authorities have therefore concentrated all the areas under their control to the north-east of the Civil and Military Station so as to have them in a small and compact block.

Whitefield, the next station, is an Anglo-Indian colony established there many years ago as an agricultural settlement, and hence called "Whitefield." It has unfortunately proved a failure and the question of resuming the land which the Mysore State gave to the Settlement has recently been seriously considered more than once because of the inability of the inhabitants of the settlement to run it satisfactorily. The settlement was located on the ridge adjoining the valley in which the village of Kadugodi was located, to avoid contact with the villagers and probably also because much of the land in the valley itself was already occupied and cultivated by the villagers. The consequence of this choice of an upland site was that the settlers had to contend from the outset

with scarcity of water even for drinking purposes. Another reason for the failure was probably the fact that the settlers tried their hands at fruit-farming and poultry-farming and other such specialised activities which could not succeed without a well-organised system for marketing the produce. The Anglo-Indians seem to be unable to settle on the land and take to agriculture, perhaps because they are born and brought up in the towns and lack the rural background needed if they are to make good as farmers. A few of the settlers still linger there and the other houses are mostly unoccupied. and for sale. These vacant houses afford facilities for picnicking and are popular for that purpose among the Anglo-Indian population of Bangalore. Immediately after leaving Whitefield Station, the railway line crosses the well-watered valley. The valley-line is marked by numerous wells and there is also a canal on the farther side of it; they are both associated with a typical pattern of fields, small in size, very level and terraced wherever necessary, carefully bunded so as to hold the water, and growing paddy. To the south of the railway after leaving Whitefield is to be seen a dome-shaped hill, which rises above the landscape and dominates the view for quite a while. The next station is Malur, where a new siding has been provided because it is a crossing station for trains, which now halt on both sides of the platform. This innovation has also been made to provide for the growing importance of the Station; Malur is an important centre of bus-routes, buses plying from here to Bangalore, Hosur and places in Kolar district.

Several rocky ridges, probably dykes, in a more or less north-south direction across the line of the railway after leaving Malur. These ridges are mostly granitic, whereas a similar ridge which may be seen shortly after crossing the valley east of Whitefield consists of very dark-coloured fine grained rocks, and does not rise as prominently as the granitic outcrops do. These granitic outcrops also form the hills which occur at Taikal where the rock has been quarried for many years to obtain kerb stones to be exported to England. The demand for these stones has led to similar quarries being opened elsewhere as at Kuppam. Shortly after leaving Malur, the houses in the villages are found to be roofed with straw or with country tiles instead of with the red Mangalore tiles which are generally prevalent all round Bangalore. Probably the limit of transport by road and in bullock carts is to be found somewhere beyond Malur, since the tiles are manufactured quite near Bangalore and trans-

ported from there to all the villages in the neighbourhood. The concentration of wells and irrigation along the valley-lines, which are marshy in some cases, and the prevalence of the scrub vegetation on the ridges is typical of the scenery of the Mysore plateau. In many of the valleys casuarina plantations may be noticed in patches; these are largely found on patches of sandy and saline soils in the valleys. The sandy soils are found in localities where (a) sheet erosion has removed the finer particles and the sand has remained as an erosion pavement; (b) the coarser weathered materials have accumulated as talus formations at the foot of the slopes; and (c) they form deposits along water courses, specially in low-lying areas suffering from inadequate sub-soil drainage. In other parts of Mysore State, these saline soils have been found associated with the presence of a kankar (nodular limestone) horizon at a variable depth below the surface. A similar horizon has also been noted in the Tiruvellore taluk of Chingleput district in the case of certain saline soils which overlie the crystalline rocks in that area; it appears to be a feature of some soils formed under conditions which are common and widespread in peninsular India.

As the train approaches Taikal, the soil colour changes from the characteristic reddish brown tinge to a greyish colour. The soil materials are derived from the underlying gneissic rocks in both cases, but have undergone sufficient changes in certain areas to bring about the reddish colour and other characteristics; in the neighbourhood of the granitic hills, the soils still retain the greyish colour of the parent rocks, because of the large amount of freshly weathered material brought down and deposited on the surface. The greyish soil has not yet decomposed far enough to develop the reddish colour which is a sign of greater maturity of soil development. These greyish soils are as a rule much poorer and shallower than the red soils, and the cultivation and villages associated with them show obvious consequences of the poorer soil conditions. The hills on both sides of the railway at Taikal are very typical of granitic weathering and scenery. Here can be seen very clearly various stages in the development of horizontal and vertical joints, and the subsequent weathering of these blocks into rounded boulders, many of which have rolled down the slopes and come to rest at the foot of the hills. We can see the blocks in various degrees of roundness, arranged in distinct layers on the bare rocky surfaces of the hills, or standing up as pillars separated by the gaps which have developed along the joints, or poised in precarious positions.

After leaving Taikal, we enter the valley of the Palar in which the new settlement of Bowringpet is situated. It has grown up after the Gold Mines were started at Kolar and linked up by a connecting railway line from Bowringpet. It is called after Mr. Bowring, who was one of the British Residents in the Mysore State. The Palar valley becomes narrower and gorge-like slightly south of Bowringpet and the scenery changes as the train descends from the plateau shortly after leaving Bowringpet. The topography becomes more uneven and the ridges are more rocky; the railway has also more embankments and cuttings as a consequence. The cultivated land becomes less extensive and the scrub on the uncultivated areas gradually becomes denser. The villages are fewer in number and smaller in size, and the rearing of livestock becomes important in these villages, as is shown by the larger numbers of cattle and sheep and goats seen grazing in this area.

Bisanattam station has recently become more important because it connects with the new gold mines which have been opened recently at the mining settlement called Narayan Nagar. It is said that this branch line may be extended from Bisanattam to Marikuppam so as to form a loop from Bowringpet to Bisanattam connecting the Kolar Gold Mines as well as this new mining settlement. The new mine has been opened on a southward extension of the same gold bearing reef which is worked at Kolar. It is reported that recent investigations have proved this section of reef to be far more valuable than various previous attempts had shown it to be. Prospecting and mining licences were taken many years ago to exploit this extension of the reef in Kangundi, but these attempts were abandoned after a while. Opinion is divided regarding the prospects of these new gold mines and its value still remains to be proved. The gold bearing reef is marked on the surface by an associated line of reddish hills which run across the railway line in a north-south direction and their smooth soil-covered slopes contrast very markedly with granitic hills.

The tank which is passed immediately after leaving Bowrinpet station is one of the largest in this part of Mysore State and provides the water supply of the Kolar mining settlement. Paddy is cultivated all through the year in the fields irrigated from this perennial source. In the middle of May, the paddy crop in the area commanded by this tank can be seen in every stage of growth. Some of the fields will just have been harvested; whereas in others the paddy crop will be waiting to be harvested; elsewhere the rice

plants just begin to put forth ears; in yet other fields it obviously has been transplanted not very long ago; and some of the fields are being prepared for planting.

The high tension power line from Sivasamudram crosses the railway in this section. It is carried on wooden poles and is a duplicate line between the generating station and the gold mines. The Kolar Gold Mines have always provided the principal load for the Sivasamudram scheme, which could not have been started if the gold mines had not existed.

The soil becomes very poor after passing Kamasamudram. The valley-lines are generally marshy and uncultivated and marked by date palms. Their presence in the poorly drained valley bottoms has also been noted in other parts of the Mysore plateau; the date palm appears to be able to grow on the saline soils which are frequently characteristic of such ill-drained valley-bottoms. (Ramachandra Rao's Soil Survey of the Irwin Canal Tract in Mandya). The Ghat section of the railway, which begins from Mulanur, is very difficult country, consisting of numerous granitic hills and ridges separated by densely wooded gorges. The enormous erosive power of the streams traversing these gorges is very apparent as the train comes down the Ghat section. In general, the rocky hills are higher to the south and west of the railway along the ghat section, some of the highest points being on this side.

Kuppam is a more or less isolated island of cultivation and settlement in the midst of the scrub jungle which covers the eastern verge of the plateau, and perhaps because of this setting, it is a zamindari estate. The Zamindar's house is the most conspicuous building in the town as seen from the railway line. A small sandalwood oil factory has been in existence here for a number of years, and it is working quite satisfactorily. Its establishment was inspired by the success of the Sandalwood Oil Factory of the Mysore Government at Bangalore. Large quantities of chrysanthemum and jasmine flowers are sent from Kuppam, at certain periods of the year when they are in season, to Madras and Bangalore, where they find a ready sale at the time of the festivals in the temples, when large quantities of flowers are used for decoration. The soil is coarse and sandy round about the place and carries very poor scrub. Here too can be seen in May the harvesting of paddy in some fields, a growing crop in others and ploughing in yet others, all at the same time.

At the foot of the Ghats, as it approaches Patchur station, the train emerges into the wide, almost level, abandoned valley of the Palar, which is in a very young stage of dissection by the streams which flow down the gorges along the edge of the plateau, and then traverse the plain. Between Jalarpet and Mailpatti, the railway line follows the reversed course of the Palar. As the train runs along the loop by which it enters Jalarpet station, we can see very clearly in the west, the huge windgap marking the former southward course of the river. After leaving Jalarpet, from the time the train approaches Vaniambadi and till it gets out of the progressively narrowing valley at Mailpatti, a series of broken discontinuous ridges may be seen to the east, mid-way between the railway line and the higher hills forming the valley side. These broken ridges become higher as we proceed down the valley. They are the remnants of the former valley floor which was 150 feet to 250 feet higher than the bottom of the valley at present, and sloped south-westward instead of north-east, because the stream in the valley had also flowed in a southwesterly direction, before it was captured at Mailpatti and its direction of flow reversed.

After passing Katpadi, we leave behind the hills which form the easternmost outliers of the plateau and get on to the sedimentary deposits of the coastal plain. The landscape changes its character correspondingly; there are far fewer hills, the surface is more level, the cultivation is more intensive and the water-supply more abundant. The larger area under paddy further serves to make the landscape monotonously green in every direction, in contrast with the valley of the Palar between Jalarpet and Mailpatti, where the crops are as varied as the scenery. At Arkonam and Wallajah Road, we see again some of the outliers of the peninsular rocks which rise above the level country as extremely conspicuous, bare, rocky hills. Outcrops of the Satyavedu pebble beds occur between Arkonam and Tiruvellore, especially on both sides of the railway line near the Tiruvelangadu station. Where the beds outcrop at the surface, they have formed extensive patches of shingle which are very conspicuous because of the total absence of cultivation as well as of natural vegetation of any character. Such a vast quantity of pebbles of all sizes and shapes is an extraordinary sight in an area where everywhere else the surface is clothed with crops of one kind or another.

All along this section of the line to the north of it can be seen rising well above the horizon in the far distance the crest of the

Nagari and Nagalapuram hills formed by the Cuddapah rocks. They persist on the horizon till we are nearly half-way between Tiruvellore and Madras. Midway between them and the railway line can also be seen, between Arkonam and Tiruvellore, a line of low ridges with an undulating crest; these are the Alicoor and Satyavedu hills formed by the Satyavedu conglomerate beds. Between the crest of the conglomerate hills and the railway line there is a third discontinuous crest, which is nearer to the railway line and also lower than the others. This marks the lateritic formations which are found scattered about as isolated outcrops in various parts of the coastal plain. We cross this lateritic belt at Avadi where the train runs in a cutting.

As we approach Madras, the extremely flat character of the landscape impresses itself upon us in many ways. The gleam of the light-house is visible from the train long before we reach even Basin Bridge Junction. And to the passenger who sees the light, the other towers of the Law College and buildings in George Town are also visible, sharply silhouetted against the sky. The coastal plain is so very flat, because it was once a lagoon, like the others which are still found on this coast at Pulicat, Colair etc., and this lagoon became filled up in the course of ages by steady deposition of materials brought down by the rivers or blown inland by the winds. The very low level of the land around the Basin Bridge Junction and along the railway line after leaving Basin Bridge makes it liable to periodic flooding, and this accounts for the stagnant water which is found in many places, and for the vast heaps of rubbish dumped here to fill up the depressions and thus raise the level of the land. The Buckingham Canal, which runs along these depressions along the coast, is parallel to the railway for the whole of this last section. Another point which is also worth noting is the industrial development, of which there are many visible signs to the traveller in the approaching train. First, there is the vast area occupied by the railway workshops at Perambur; nearer to the city there are several other factory chimneys belonging to the cotton mills situated in the north-west of the City. The route by which the train approaches Madras is not likely to impress upon the stranger's mind that he is nearing a large city with about three-quarters of a million persons. We may contrast Madras in this respect with Bombay, where, long before the destination is reached, the veritable forest of chimneys of the cotton mills, the miles upon miles of the lofty buildings and crowded streets on both sides of the railway line, the numerous suburban

stations passed, and the multiple track of the railway, all serve to emphasise the size and importance of the city. The impression obtained by the passenger who reaches the Egmore station is more appropriate, if we may say so, to the city which is nearing; the succession of suburban localities and stations seem to raise in one's mind an expectation of something greater to follow. The main reason for the unimpressive character of the railway approach to the Central station is the absence of suburban development along the railway line; there are suburbs of the city along this line also, but they are so far away from the railway line as to be invisible, and in general it is only the waste land and cultivation that borders the railway.

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No attempt has been made in the foregoing account to be exhaustive; hence it will be quite possible to supplement what has been said with an even larger amount of detail. The main purpose of this account is to arouse interest and to show how an event in every-day life can be usefully exploited by the geographer. A series of similar accounts of journeys along other routes should form a most useful collection, supplying geographical information suitably assembled for this particular purpose. Such a collection would undoubtedly prove most useful to the student and teacher of geography alike, specially on excursions when they have to travel by train.

* Epic of Mount Everest

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To reach the peak of Mount Everest, the highest point on the surface of the Earth, on foot has been the unfulfilled ambition of man for long. In spite of man's unyielding pride as the conqueror of nature, and the immense resources and scientific devices at his disposal he has not been able so far to succeed in this attempt Even to-day Mount Everest stands majestic a challenge to man.

It is to the various attempts made by man to reach its top in which many have risked their lives, that this talk relates.

Dear young listeners, I propose to tell you to day the thrilling but unfinished story of the several attempts made to climb Mount Everest, the highest peak in the world, which rises to a height of 29,002 feet.

This peak is situated on the border between Nepal and Tibet; and both the Nepalese and the Tibetans look upon it as holy ground. and have no desire to climb it. But to the European mountaineers, trained in Alpine climbing, it has thrown a challenge, luring them to plant their foot on its summit.

This idea of climbing Mount Everest arose early in the present century; but, before it could mature or materialise itself, the Great War intervened, and it had to be held up for a time. The War itself gave a great impetus to flying; and airmen had proved that man *can* ascend much higher than Everest with the help of oxygen. But, man's ambition drives him to find out if there is any part of the earth's surface so high that he cannot by his unaided effort reach it. So, he selects the highest mountain for his experiment.

So far five serious attempts have been made to reach the summit of Everest—two in the last decade in 1922 and 1924, and three in the present decade in 1933, 1936, and 1938. Though their details are very thrilling, nothing more than an outline can be given here.

* A radio talk given at the A. I. R., Madras, on 17—3—1939.—Published with the permission of the Station Director, Madras.

In 1921, after obtaining the sanction of the Dalai Lama at Lhasa, a preliminary expedition was sent out, whose work was restricted to reconnaissance, pure pioneering survey of an altogether unknown country. After many arduous weeks of reconnoitring, the defences of Everest were found to be forbidding, 'a southern face (on the Nepalese side) grimly guarded by great precipices; eastern and western flanks barred by hanging glaciers. After further inspection, a route to the summit was found practicable by a col or saddle (since known as North Col), which led up to the main peak by a north-eastern ridge. To the west of the North Col was the head of the Rongbuk Glacier, and to the east of it the East Rongbuk Glacier, a tributary of the former. It is by the route up the eastern side of the North Col, reached by the East Ronglbuk Glacier, all subsequent assaults were made upon Everest, except the last one in 1938.

The reconnaisance of 1921 led to the first actual expedition of 1922. Leaving Darjeeling on March 26 the expedition, consisting of climbers, porters, provisions, equipment, etc., trekked through Sikkim and across Tibet, reaching the Base Camp in Rongbuk valley on May 1. This month's march over the plateau whose altitude is 15,000 feet, though wearisome, did good in hardening and acclimatizing the climbers.

It may be stated here that the mountain can be tackled only in a short interval of about three weeks only between the excessive cold of winter and spring and the breaking of the monsoon in summer, when alone it is assailable. "Just by one narrow strip of space and for a short moment in time is the mountain vulnerable."

A chain of four camps was put up, the fourth one being on the North-eastern Ridge at a height of 23,000 feet.

In the first attack, which was made on their lung power, the climbers, benumbed in body and mind, pushed on, struggling for breath, and reached the remarkable height of 27,000 feet. Feeling exhausted, and battered incessantly by biting gale, they retraced their way back to the camp.

Meanwhile oxygen cylinders were brought up; and three fresh leaders wore them, and made a second assault, reaching a height of 27,300 feet. Though well within 2,000 feet of the summit, they were repulsed and had to retreat.

The third attempt ended in a tragedy. The monsoon had commenced; and even while the North Col was being scaled, an

avalanche overwhelmed a party of 9 porters, two only of whom were recovered alive. This tragic occurrence brought the assault of 1922 to a close.

As a result of this expedition, the mountain itself was found to be no obstacle, as it was only a bare rocky peak. The real hindrance was the weather—the terrific winds, the cold and the snowing, especially the last.

Regarding the use of oxygen against the thin air, there was difference of opinion ; and both methods were therefore tried again in the next expedition which was fitted out in 1924. The party reached the site of the old Base Camp on April 19. The three lower camps were set up along the East Rongbuk Glacier as before, leading to the North Col ; but bad weather—gale and snowing—prevented action for some days. When it cleared, the attempt was renewed; and the three higher camps were put up on the north-east ridge with the greatest difficulty at 23,500 feet, 25,500 feet and 27,200 feet respectively.

From Camp VI, the highest as their base Norton and Somervell were able to climb up to 28,000 feet *on their own lung power.* They had, however, to retreat, Somervell suffering from sore throat and Norton from snow blindness.

Mallory, a veteran climber and Irvine a junior next went up as the *oxygen party.* But there could be no direct account of how they fared. Odell, who went up to observe them, has given the following account :—" I noticed far away on a snowy slope......a tiny object moving and approaching the rock step. As I stood intently watching this dramatic appearance, the scene became enveloped in cloud once more; and I could not be actually certain that I saw the second figure join the first." It is not known whether the pair reached the summit or not. Nothing more was known of them. The main party, after scrutiny and waiting, accepted the sad reverse and returned.

By reaching so near the summit, the 1924 expedition proved that climbing the Everest is possible.

For the next 9 years Everest remained undisturbed. In April 1932 there was an aeroplane flight to Everest for making photographic survey of the region, preparatory to the ground expedition of that year under Ruttledge. In establishing the Base Camp he had an advantage of full 12 days over the predecessors. The same

six camps were to be established as in 1924; and Camp III was fitted with a wireless receiver to report the approach of the monsoon across the Bay.

Before Camp V could be secured, however, there was gale and snowing ; still there was no thought of retreat. On the other hand. Wyn Harris and Wager climbed to 27,400 feet and planted a small tent within half a mile of the summit : and as they went upward and the weather cleared, Wyn Harris found an ice-axe, lying on the smooth slab, looking surprisingly new. There is no doubt it belonged to either Malory or Irvine, and must have escaped its owner's grip on their fatal downward journey. After reaching 28,100 feet, the limit of Norton in 1924, they felt that safety lay in return, and descended.

Of Smythe and Shipton that made the next party of ascent, the latter had to return due to stomach trouble; and the former who pushed alone to about 28,000 feet, returned after escaping a terrible accident, as a small protuberance on which he was standing came clean away.

The descent was resumed in a storm; and soon Everest was clothed completely in snow. The whole party had to hurry back and give up the attempt.

A reconnoitring expedition in 1935, as in 1921, did excellent survey work among glaciers and mountains, incidentally climbing several high peaks.

This was followed in 1936 by a strong expedition fitted out at a great cost under the leadership of Ruttledge. While everything was very promising at the outset, heavy snowing impeded progress and imprisoned the climbers in their camp for some days, while two of them escaped being buried alive by an avalanche. Feeling that the limit of possibility had been reached, the attempt was abandoned and the party returned, without accomplishing anything.

The last expedition of 1938 was organised on a much smaller scale than all the previous ones on the score of mobility, efficiency and economy. Rongbuk was reached 10 days earlier than the earliest of previous expeditions to avoid a repetition of the 1936 experience. But the monsoon broke still earlier than in that year ; and until it broke, wind and cold made climbing impossible. The heavy and frequent snowing made the east face of North Col impracticable ; and an assault was made from the west for the first time, marching by the main Rongbuk Glacier. All the six camps

were again established with great difficulty: but when attempts were made to advance beyond Camp VI (27,000 feet), it was found that deep powder snow had made the slabs slippery and dangerous. The party had to return, frustrated again by cold and snow.

Thus ended the latest assault of 1938. But the expedition has shown that a small party is as likely to reach the top as a large and costly one. Tilman the leader thinks that the mountain could and should be climbed without oxygen, and that *weather* is the all important factor; for sure success. he says. conditions on the last 2000 feet must be perfect.

Man has thus proved his physical capacity to climb over the earth's greatest height; and the attempt will not be abandoned until it is actually done. "Man comes to it again with increased knowledge, increased experience and increased spirit."

So far it is the British climbers that have been taking part in this glorious enterprise. Is it too much to expect some of our Indian young men, possessing the same strength, skill and indomitable spirit to train themselves to the task and try to achieve similar success?

It is the astonishing endurance of the Indian porters the Ghurkas and the Sherpas—labouring up with camp loads, on their own lung power, to a height of 27,200 feet, that made the pitching of the last camp possible, and enabled the leaders to sally out on the crowning adventure.

Indians have won distinction in hockey and other games, in the army and in aviation. They could easily take to mountaineering with equal zest and success, especially as the opportunity for it lies in our own country, for the glory of which climbers come from abroad.

Correspondence

To the Editor,

Sir,

Permit me to comment upon two points arising out of the papers published in the last (January-March 1939) number of the Journal.

In "Impressions of the Lahore Science Congress" 1939 (Page 60), it is stated that I criticised Prof. Pithawalla's Paper on "The Need for *Uniformity in the Physiographic* divisions of India" on the score that "it did not adequately provide for climatic differences." I have since received a letter from him on this matter, and I wish to make it clear that the particular interpretation which has been made of what I said during the discussion of his paper at Lahore *on climatic boundaries, is neither what I intended* nor fair to Prof. Pithawalla.

At the discussion of his paper at Lahore I tried to point out that the proposed physiographic units provided a frame-work to which climatic regions did not readily conform. I was thinking particularly of the southern portion of the peninsula comprising the Tamil Region, Kerala, and, if we may regard it as a separate region the intervening highland region, which though it narrows down to a range of hills, is nevertheless analogous in position and structure, to the Dekkan plateau further north. By means of sections and some details regarding the climate, occupations etc., I tried to show how, in the central portion i.e., the zone of ancient crystalline rocks outcropping between the two coastal alluvial belts, we have on both sides of the range of hills, more or less extensive lowlands which resemble the adjacent alluvial tracts in many respects, though structurally they are different; whereas there is only the structural similarity to unite the range of hills in the middle with the adjoining lowlands.

It is possible, in the light of the physiographic "process" by which the coastal plains have been evolved, to regard both the coastal alluvium and the adjoining lowland as results of the same agency, namely, marine denudation. The sea appears to have been mainly responsible for producing the coastal plains; the interior lowland is probably the result of the marine denudation, and the materials derived in the process of planing down this marine platform have been transported outwards and deposited to form the

coastal fringe of sediments of various ages. Hence there is no sudden change in relief as we proceed inland from the alluvial belt or vice versa.

I believe it will be evident, therefore, that it is necessary to carry out any such scheme of divisions, physiographic, climatic or otherwise, to such minuteness, that the smallest units will then be common to all the schemes, and the larger units will be, more or less, different combinations of these small units. For such a detailed scheme of division of India, however, there is still an enormous amount of work to be done by geographers. To mention but one example, attention may be drawn to the lack of any systematic description of Indian landforms, which, as Prof. Pithawalla himself has pointed out, has to be remedied by geographers. The difference between what Prof. Pithawalla has done and what I said, is mainly a question of approach to the problem and not one of principle. It is, I am sure, quite unnecessary for me to point out that to criticise any scheme of *Physiographic divisions* as not taking climatic differences into consideration will be irrelevant.

The second point concerns all geographers in South India and arises out of Dr. Geddes' statement in his paper that " In Southern India, at this time,—I was struck by the rarity of any discussion of possible economic provinces. The concept of the region, and even the word is rarely met with." It seems hardly fair to ignore so completely the work done by geographers in South India.

Yours Faithfully,
B. M. THIRUNARANAN.

Report of the Summer School of Geography

(held at Saidapet in April-May 1939)

The Secretary of the Association has the honour to present the following Report of the Summer School of Geography, held at the Teachers' College, Saidapet in April-May 1939 :—

At its meeting held on 17-2-1939, the Executive Committee decided to hold a Summer School of Geography in April-May 1939, and authorised the Secretary to organise and conduct the course as in previous years. 31 teachers joined the School (Appendix I), some of them coming from distant places such as Janjira, Poona, Hyderabad, and Kottayam.

The classes were formally opened by Miss J. M. Gerrard at 10.30 A.M. on Monday the 17th April 1939 with an Address (Appendix II). The work of the Summer School went on steadily for five weeks at 5 to 6 hours a day; and the following scheme of work was gone through :—

(a) *Pedagogy of Geography* by Mr. N. Subrahmanyam;
(b) *Elementary Surveying* by Mr. K. Srinivasaraghavan;
(c) *Map Work* by Mr. N. Subrahmanyam;
(d) *Mathematical Geography* by Mr. M. Subramaniam;
(e) *Diagrammatic Methods* by Mr. S. Balakrishna Ayyar;
(f) *Land Forms* by Mr. V. D. Krishnaswami;
(g) *Climate & Weather* by Miss E. D. Birdseye;
(h) *Oceanography* by Mr. K. Ramamurthy; and
(i) *Economic Geography* by Mr. V. Thyagarajan.

The following general lectures were also delivered to the teachers atending the course:—

(1) *Some Aspects of Plant Geography* by Mr. M. S. Sabhesan;

(2) *Earth as the Abode of Man* by Mr. George Kuriyan;

(3) *Identification of Rocks* by Mr. P. G. Dowie.

Miss H. T. Scudder gave a show of *Geographical Films.*

Besides short excursions to St. Thomas Mount, Pallavaram Hill, Madras Harbour and Ennore Backwaters, two whole-day major excursions were conducted by bus under the joint auspices of the Summer School, the Geographical Conference and the Pro-

vincial Educational Conference. The first of them which included a party of 45 persons in 3 buses was a circular tour, conducted on 6th May to Poonamallee, Sriperumbudoor, Trivellore, Tripasore, Pundi, Uthukottai, Manjakaranai, Red Hills Tank and Kilpak Waterworks. The second major excursion was on 7th May to Tirukkalukundram and Mahabalipuram.

On the afternoon of 20th May, the last day of the course, a tea party was held, after which Mr. M. Subrahmaniam presented the certificates to the teachers who attended the Summer School, and delivered the valedictory address to them.

The total collection of fees amounted to Rs. 465, out of which a sum of Rs. 115 was expended on conveyance allowance of lecturers, clerical and other services and miscellaneous expenses, leaving a net balance of Rs. 350.

The thanks of the Association are due to the Lecturers for their honorary work in the Summer School as well as to the Director of Public Instruction, Madras and the Principal, Teachers' College, Saidapet, for permitting the Officers of the Educational Department to work in the Summer School and for allowing the classes to be held in the Geography Department of the Teachers' College.

APPENDIX I

List of Teachers who attended the Summer School of Geography in April—May 1939

1. *Aiyakutti, Mr. K. S.*, M.A.; 32 Pycroft's Road; Triplicane, Madras.

2. *Ananthachary, Mr. T. S.*, B.A., Thillayambur, Valangaman P.O.

3. *Devadasan, Miss N.*, B.A., L.T., Methodist Girls' High School, Royapettah.

4. *Devaprasadam, Mr S.*, M.A., L.T., Model High School, Saidapet.

5. *Gokulapala Sarma, Mr. V. G.*, B.A. Hons., L.T., P. S. High School, Mylapore.

6. *Jagannathachari, Mr. C.*, M.A., Srinivasa Agraharam, Triplicane.

7. *Jayaraman, Mr. S.*, B.A., L.T., Muthiapet High School, Madras.

8. *Kothandaraman, Mr. N.*, Higher Elementary School, Gopala-

9. *Krishnamurthy, Mr. P. R.*, B.A., P. S. Higher Elementary, School, Mylapore.

10. *Krishnamurthy, Mr. P. V.*, B.A., Poyyamani, Pettavaithalai P.O.

11. *Luke, Mr. Ch.*, B.A., L.T., Methodist Boys' High School, Hyderabad.

12. *Nagasubramaniam, Mr. S.*, B.A., L.T., A. C. High School; Pallatur.

13. *Narasaiah, Mr. P.*, B.A., Magampeta Agraharam, Kodur, P.O.

14. *Narayanaswami, Mr. G. K.*, Primary Department, Muthialpet High School, Madras.

15. *Patankar, Mr. M. N.*, Modern High School, Poona.

16. *Phadake, Mr. G. D.*, M.A., B.T.; Private High School; Pen-(Bombay Presidency).

17. *Raghunadhan, Mr. N. R.*, B.A., Singaram Pillai Higher Elementary School, Villivakkam.

18. *Santhana Rama Iyengar, Mr. C.*, Hindu Union Committee School, Choolai, Madras.

19. *Solomon, Mr. Paul Edward*, S. P. G. Secondary School, Cuddalore O.T.

20. *Srinivasan, Mr. A.R.*, Hindu Union Committee School, Choolai.

21. *Srinivasan, Mr. A. V.*, B.A., Hons., Trichinopoly.

22. *Srinivasaraghava Iyengar, Mr. S.*, B.A., Hindu High School, Triplicane.

23. *Sriramadesikachari, Mr. R.*, B.A., Srikalpakavalli Balika & Bala Patasala, Mylapore.

24. *Subramanian, Mr. K. V.*, B.A., No. 7, Chidambaraswami Street, Mylapore.

25. *Sundara Raju, Mr. D.*, B.A., L.T., Concordia High & Training School, Ambur.

26. *Thomas, Miss Grace*, B.A., L.T., Baker Memorial School, Kottayam.

27. *Vadivelu, Mr. P.*, B.Sc., Mathanam, Shiyali Taluq.

28. *Venkataraman, Mr. S.*, All Saints' High School, Hyderabad.

29. *Venkataraman, Mr. S. K.*, B.A., L.T., Kindergarten Section, Teachers' College, Saidapet.

30. *Virkud, Mr. M. G.*, B.Sc., Sir S. A. High School, Murud-Janjira.

31. *Vithal, Mr. G. R.*, Nutan Marathi Vidyalaya High School, Poona.

APPENDIX II

Inaugural Address

BY

MISS J. M. GERRARD

It is a great pleasure to me to be here to-day to open this Summer Course in Geography: for I consider the establishment of this course year after year a notable achievement of the Madras *Geographical Association*. *It is over 10 years since the course was first started*: and when you consider how comparatively small is the Association (i.e., how few in the number of trained geographers) and what little support it gets, this *continuity* is little short of marvellous. This Summar Course in Geography has become an *established tradition*; and without advertisement applications for attendance come steadily in year after year.

Teachers' College may be called the first home of Geography in India: and as many of you know, its Lecturer in Geography, Mr. N. Subrahmanyam is the doyen of geographical studies. The spirit of the place must have been seriously ruffled last year—when the summer course was held at Bangalore at the invitation of the Vice-Chancellor of Mysore University. I feel glad that the College is once again the venue of a band of enthusiastic teachers from the four corners of the peninsula.

The directing force, as I have said, has been the Madras Geographical Association,—and for a long time Mr. Subrahmanyam has been the life force of that Association. The way it has successfully nursed the tiny seed of geographical research through these difficult years is, I think, a magnificent achievement; and side by side with that has been its influence upon the teaching of Geography in the schools through these vacation courses.

To-day we have a situation in which the schools and the teachers are crying out for training in Geography. From Hydera-

bad, from Bombay, from Travancore they are here to-day, besides from all the districts of our own Presidency! But the Colleges stand aloof, refusing to give the instruction for which there is so great a demand. Thus the future Geography teacher is *penalised* by having to put in a fifth year, if he wants to be fair to his pupils, and he takes the Diploma Course of the Madras University. That there are some who do take this extra year says a great deal both for them and for the interest the subject gives. Such men and women are the fortunate few who can afford it, and they are limited to a large extent to those who live in the metropolis. But for the greater number of Geography teachers—in the schools of this Presidency alone—*no* opportunity for geographical study is *provided.*

This is where the Madras Geographical Association steps in with its introductory course

Geography is one of the most difficult subjects to teach. Partly it is due to the fact that the subject as a science is developing so rapidly. To look back 25 years as I can, is to realize what strides have been made, and how the emphasis has changed. For the school teacher there is first the *problem of selection*—what regions to teach and how much detail to be demanded at each stage. Local geography, the homeland, the world—all three have to be kept going simultaneously. There is *no* subject in the school curriculum which needs so much adjustment to the conditions of the local environment; and every Geography teacher must be capable of re-arranging his teaching syllabus accordingly. Then there is the need for *training in geographic method* and in the *tools of learning.* You cannot take a course in map-reading and finish it off in any one year—this involves a *progression* of training to be accomplished in the whole school scheme. (And what are we going to do about teaching the one-inch map when the medium of instruction is Tamil or Kannada etc.?). The teaching syllabus has to plan for this progression. The teaching of climate similarly has to provide for training in the recording of local observations, in the reading of maps showing the distribution of temperature, pressure and rainfall, and the study of climatic regions—each with its *regime* of temperature and pressure through the year, where both a spatial and a time factor have to be taken into account. In each year of the school scheme something of this has to be provided for, each stage a little more difficult than the last. Thus all the three aspects have to be provided for, simultaneously in teaching Geography in school—acquisition of skills in the use of geographic

tools, the development of geographic ideas, and the acquisition of geographical facts. Such is the nature of the subject, which is to be taught, apparently, *without any previous training*—by the light of nature alone.

Now this course has been admirably planned to help the teacher. *This year it has been extended to a period of five weeks,* giving 180 hours of work; thus it is more intensive than the training given to the Geography teacher in the L. T. course. The emphasis is to be placed on practical work; and this is most wise, for not only is practical work becoming of increasing importance in the school curriculum, but it is just that part of Geography which is most difficult for the learner to acquire without a guidance and help. The middle school course should be two-thirds practical. We have tried out this experiment in our school for the last two years; and the good results most noticeable are—the children get a grasp of the fundamentals of Geographic method, the use of maps of all kinds, the value and use of statistics, training in direct observation and some elementary training in deduction and induction, which helps them to understand the work in the upper forms. Unless time is given to this kind of training in the middle school, the later work can be nothing but unintelligible cram.

This course has been planned to give something of that practical foundation. Surveying, you will find, will give you a fresh outlook altogether, and a new sense of power over your environment, besides a deeper understanding of maps. Every school should have a map of its building and lay-out of its grounds, and it is the business of the Geography teacher to produce this. I believe the middle school Mathematics and Geography teaching would *benefit by the introduction of a little map-making.* This was tried out last year in Form I of the Wesley School, and I believe the interest and enthusiasm shown by the boys was astonishing. The course on map-reading will also be particularly valuable to you, and especially that on the one-inch map, since there is no treatise published to guide you in the intricacies of the geographical interpretation of Indian maps.

In fact, the whole course has been admirably planned to help you; it is being taught by a body of experts; and your teaching of the subject will be enormously enriched by this introduction to it. Not only that, but it will also open a vista to an entrancing subject; and some of you I hope will want to follow it up the whole way. You can do that by taking the Geography Diploma to be

followed up later by an Honours course at some Indian University, if you are lucky enough to get a windfall in cash !

Fellow-teachers —let me congratulate you on your enterprise and your sense of duty to your profession, evidence of which is your attendance here ; let me prophesy for you five weeks of intense activity—considerable exercise of brain and limb—and at the end a feeling of satisfaction at a piece of work well done !

The Madras Geographical Association:

Proceedings of the Ninth Geographical Conference May, 1939
Madras Session.

The Ninth Geographical Conference of the Association was held at the Leith Hall, Triplicane on the 8th, 9th and 10th May 1939 under the Presidency of Prof. Rao Saheb C. S. Srinivasachari, M.A. of the Annamalai University.

The opening session of the Conference commenced at 2 p.m. on Monday the 8th May before a gathering of members and visitors. After formal Welcome by the Secretary, Prof. V. Rangachari proposed as President Prof. Srinivasachari who was installed in the chair, after being seconded by Mr. Guruswami Sastri and supported by Mr. A. Tirumalai Iyengar. He then delivered his Address on *the Historical Geography of Madras* (published elsewhere).

Two papers were then read in that session—the first by Prof. V. Rangachari on "Some Place-Names of Madras", and the next by Mr. V. D. Krishnaswami on "Surface Levels of Madras."

Three papers were read at the second session of the Conference, which met at 2 p.m. on Tuesday the 9th May. The first was by Mr. C. C. Armstrong, Chairman, Madras Port Trust on "the Port of Madras"; the second by Mr. N. Subrahmanyam on "*Some aspects of the Recent Growth of Madras*"; and the third by Mr. K. C. Ramakrishnan on "*the Milk Supply of Madras.*"

The concluding session of the Conference was held at 8 a.m. on Wednesday the 10th May, when the first paper read was on "*the Fruit Supply of Madras* by Mr. H. Punja. The next was a paper by Dr. P. S. Loganadhan on "*the Industries of Madras.*" The last was on the *Buckingham Canal* by Mr. T. P. Venkatachari.

The remaining papers contributed for the Conference were taken as read owing to the absence of its authors and for want of time. The President then delivered his concluding Address in which he eulogised the abiding work of the Association in the shape of original papers read at the ordinary meetings and the Conferences, publication of the journal which is well-known in this country as well as abroad, the summer schools and Refresher courses, excursions etc. The Conference then came to a close with a vote of thanks by the Secretary.

Reviews

Physical Geography and Geology. By L. Dudley Stamp (Indian Edition). (Longmans, Green & Co.). 1939. Price Rs. 2 as. 8.

This book is an attempt to build up a knowledge of Modern Geography upon a geological basis, thereby helping to a better understanding of the subject and also to arouse interest in the fascinating secrets of the earth itself. The first twelve chapters deal with the usual topics of Physical Geography, written with a geological emphasis, while the last two chapters of this Indian edition deal with " the History of the Earth " and " the Physiography of India, Burma and Ceylon " in an elementary and interesting manner. The book is copiously illustrated with choice pictures and diagrams, several of the views being Indian; and the treatment is simple and clear. It is suitable for use by students of the High School who take an optional or advanced course in Geography (like the C-Group Geography in Madras) and by the first year University students as introductory to the study of *Physical Basis.*

Discovering Geography: Book 1-Britain. Book 2-Abroad: By T. Herdman. (Longmans, Green and Co., London). Price 1sh. 9d. each.

These two books are prepared on a novel plan, in which the pupil's personal knowledge of the facts of local geography forms the approach and the means to the study of the Geography of the Homeland (Book 1) and of the rest of the World (Book 2). As suggested by the title, he is made to *discover* Geography, in the following manner. Each chapter is prefixed by about a page of preparatory questions, in answering which he will discover something about the Home District or of the chief ideas introduced in it. At the end of each chapter, questions are appended under two heads. The first set entitled "*Do you understand the chapter*" compels careful reading of the chapter as well as the use of the atlas; while the second set "*Now can you discover*" induces further revision, and use of maps, statistics, etc. In the last chapter, the pupil is expected to prepare his own Geography of the different regions of the Homeland and of the World in an outline manner, dealing only with essential points. The books are well illustrated with a number of good pictures, maps and diagrams.

Middle School Geographies : Man's Life on Earth. Books 1, 2 and 3 for forms 1, 2 and 3 (Tamil and Telugu). By Helen T. Scudder. (Oxford University Press). 1938 & 1939. Price 12 as, 14 as. and 14 as.

These text books in Geography for forms 1 to 3 have been prepared by a qualified and experienced teacher of Geography in accordance with the recently revised official syllabus of the Madras Educational Department.

At the commencement of each chapter the main points to be learnt are set forth ; and the subject matter is then dealt with in a simple, clear and descriptive way, making an appeal to the pupils' experience or observation, and asking him to do and learn. At the end of each chapter are given suggestive and stimulating questions and exercises which help to revise and to supplement. The copious and useful illustrations, bold print, glazed paper and fine get-up make the volumes attractive to the pupils.

Modern School Atlas. Edited by W. R. Kermack. (W. & A. K. Johnston, Ltd., Edinburgh). Price Re. 1 as 2. ps. 6.

This is one of the good atlases for high school pupils available at a moderate price. It contains physical, political, climatic and economic maps of the several continents as well as of the world with sectional maps of Europe and of the British Isles and a useful index. For use in Indian schools, however, it has to be re-published with systematic and sectional maps of India, omitting if necessary some of the sectional maps of Europe or of the British Isles. One of the great merits of this atlas is the clarity of the maps, due largely to the avoidance of overcrowding of names.

A Map Book of Europe for School Certificate Forms. By A. Ferriday. (Macmillan & Co., Ltd., London). Price 1sh. 9d.

This map book is suitable for use in senior forms, preparing for school certificate examinations. It contains over 40 sketch-maps the details of which are explained and in some cases supplemented by the matter given on the opposite page.

The questions and exercises at the end of the letter-press will serve to test the pupil's capacity to illustrate his answers with sketchmaps. A similar map book for India is a great desideratum.

The Regions of the World in Pictures : Northern Africa. With descriptive notes by G. J. Cons. (University of London Press). Price 1sh 3d.

It is now universally recognised that the teaching of Geography in schools should be made interesting and realistic in various ways of which the use of illustrative material is not the least important. While pictures are available in plenty nowadays, it is necessary that they should be selected for their geographical content and value. The set under review is one such, containing 16 typical pictures of landscape, physical and human, in Northern Africa—in the Nile valley, Sahara Oases and Barbary States, illustrating the life and work of man in the several regions there. Useful descriptive notes are appended to each picture, drawing attention to salient points of geographic interest. The price is low for the value and quality of the pictures.

News and Notes

A Summer School of Geography was held at the Teachers' College, Saidapet under the auspices of the Association from 17th April to 20th May 1939. It is interesting to note that some of the teachers attending the course came from such distant places as Bombay, *Poona, Janjira, Hyderabad and Kottayam. A report of the course* is published elsewhere.

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The Ninth Geographical Conference of the Association was held at Madras on the 8th, 9th and 10th May 1939 at the Leith Hall, Triplicane under the Presidency of Prof. Rao Saheb C. S. Srinivasacharya. His Presidential address on "*the Historical Geography of Madras*" along with some of the papers read at the Conference are published in this issue. The remaining papers will be printed in the next (September) number.

* * * *

Under the joint auspices of the Geographical Conference, the Provincial Educational Conference and the Summer School of Geography, several short and two whole-day excursions were conducted —the latter on 6th and 7th May. The first of these major excursions was a circular tour in which the main object was to study some of the geological formations round Madras as well as the sources of its water-supply. The second major excursion on 7th May was to Tirukkalikundram and Mahabalipuram.

* * * *

The Tenth Geographical Conference will be held at Tinnevelly (Tirunelveli) in May 1940, when papers on various aspects of the Geography of that district will be read and discussed. This will complete the study of a contiguous region and fill a gap.

* * * *

The Coimbatore branch of the Association has been continuing to show steady work. Under the auspices of this branch a public lecture was delivered on 3—6—39 at the Y.M.C.A. Hall by Mr. N. Subrahmanyam on "*Geography in Everyday Life*" with Mr. U. Kannappa, District Educational Officer, Coimbatore in the chair.

* * * *

With the reorganised L. T. Course, the syllabus in Geography has also been completely revised, being made at the same time a bit more elaborate and specific. To meet the present situation, in which students are taught the pedagogy of geography without a preliminary training or qualification in subject-matter, special re-

gions are to be prescribed each year, a knowledge of which will be required in answering the questions on padagogy.

* * * *

In the absence of the co-operation of the colleges, which have refrained from providing for the teaching of Geography for which the University has passed regulations, the Diploma is the only other qualification in subject-matter that is available for the prospective teacher of Geography. It is to be regretted that the new regulations have failed to prescribe this or even Intermediate Geography as a preliminary qualification for admission to the L. T. course in Geography. So, the anomaly of putting the cart before the horse, or the cart alone without the horse, will continue.

* * * *

In the S. S. L. C. course, A-Group Geography is getting to be more and more popular: and the Examiners' Reports state year after year that there is a steady improvement in the answers of the candidates. But the teacher of Geography can get no credit for it, nor discredit when his work is slack, as the S. S. L. C. authorities have refused to show the History and Geography marks separately, before adding them.

* * * *

At the same time, practically no scope has been given to the high school pupils to specialise in Geography ; and only a dozen out of over 400 schools teach C Group Geography. More schools and more teachers of Geograpby are keen on providing for its teaching; but so long as it is a blind alley, leading to no college studies, they cannot have it. *Meantime mutual impoverishment continues merrily*—Colleges not supplying to schools teachers who have taken their degree in Geography, and schools not supplying to colleges pupils who have *specialised in Geography* in their S.S.L.C. course. The pessimist puts the question " Can the situation improve in a decade or two ?"

* * * *

Intermediate Geography offers a good grounding for economic and geological studies in the degree course ; but due to the intransigence of the colleges, that foundation has not been provided anywhere and cannot be availed of.

* * * *

The syllabus in Geography for forms 1 to 3 has recently been revised and modernised. But the training in Geography of the secondary grade teacher who is to handle it remains as it was several years ago. It is hoped that the Secondary grade training syllabus will soon be brought into line with the L.T. syllabus.

* * * *

The Elementary School has not yet been touched at all in the matter of Geography teaching. While deprecating the introduction of an elaborate and uniform syllabus at that stage, we would strongly urge the need for some guidance being given to the elementary school teacher which would help him to teach some good Geography to the children.

* * * *

While such is the position of Geography and Geography teaching in schools and colleges, the *teacher of* Geography does not seem to have a place or status in several schools ; and anybody is thought to be good enough for handling the subject. This view is not surprising as the Educational authorities do not insist upon the possession of the requisite qualification.

* * * *

The 27th session of the Indian Science Congress will be held at Madras from January 2 to 8, 1940. Dr. S. P. Chatterjee of Calcutta University has been elected President, Mr. George Kuriyan the Recorder, and Mr. B. M. Thirunaranan the Local Secretary of the Geography and Geodesy section for this session. It is hoped that several good papers will be contributed to this section, which was confirmed as a separate one only last year.

* * * *

We are glad to record that the Lecturers in Geography at Lahore have organised a University Branch of the Punjab Geographical Association with Miss C. L. M. Geary as President and Prof. E. T. Dean as secretary. The following are among the papers read in their monthly meetings :—

Poona and its Surroundings (Miss C. L. M. Geary) ; Present Political Situation in Central Europe (Mr. A. N. Kapur) ; Social Customs of some of the Tribes of South Africa (Mr. Farhat Ullah Khan) ; and the Damian beyond the braided Indus (Prof. E. T. Dean).

* * * *

The British Association for the Advancement of Science will hold its next annual session at Dundee August 30—September 6, 1939. The President of the E. Section (Geography) is Mr. A. Steevens. Head of the Department of Geography at Glasgow, and its Recorder Mr. J. N. L. Baker of the School of Geography, Oxford.

* * * *

The World Federation of Educational Associations will be meeting in Rio de Janeiro in August 6—11, 1939. The agenda of the Geography section of this Conference includes :—

(*a*) *Methods of establishing closer contacts* between geography teachers in different countries.

(*b*) Sources of Geographical pictures, etc.

(*c*) Means of keeping teachers' knowledge of Geography up-to-date.

* * * *

We welcome with pleasure *the Geo-Press Service*, which illustrates *rapidly all important political, economic and social* events, natural phenomena and the leading explorations, with clear and comprehensive maps accompanied by adequate comments ; and is edited by a staff of expert geographers. In the present rapidly shifting times when far reaching events are of daily occurrence, the Geo-Press Service, Geneva fills a gap.

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A New Orographical Globe—By David L. Linton.

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Exploration of Ancient Sites in Northern Afghanistan—By Evert Barger.
A New Trans-African Route—By A. E. Filby.

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A Journey in Dutch Guiana—By Ivan Sanderson.
Two Waterfalls in British Guiana—By Paul Zahl.

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A Geographical Examination of the Development of Scottish Railways—By Andrew C. O.'Dell.
Forest or Bog: Man the Deciding Factor—By J. W. Watson.
A New Index for the Analysis of Regional Trends—By Peveril Meigs.

Geography: March 1939.

The Geography of Minerals—By Sir Thomas Holland.
The Influence of Climatic and Other Geographical Factors upon

the Growth and Distribution of Population in Saskatchewan —By Stella W. Alty.

Geography: June 1939.

The Evolution of the Ship in relation to its Geographical Background—By A. Davies and H. Robinson.

An Enquiry into the Likes and Dislikes of Elementary School Children in Geography—By Beatrice M. Swainson.

Geographical Review: April 1939.

Sea to Sahara: Settlement Zones in Eastern Algeria—By Griffith Taylor.

A Permanent Loss to New England: Soil Erosion resulting from the Hurricane—By H. H. Bennett.

The Law of the Primate City—By Mark Jefferson.

Post-war Locational Changes of British Industry—By E. G. Mears.

Recent Exploration in the Polar Regions—By R. P. Platt.

The Agricultural Value of Californian Soils—By H. J. Wood.

Books and Journals Received

Physical Geography and Geology: By L. Dudley Stamp.
Discovering Geography: *Books* 1 & 2: By T. Herdman.
Middle School Geographies: *Books* 1, 2 *and* 3 (Tamil and Telugu): By Helen T. Scudder.
The Modern School Atlas: Edited by W. R. Kermack.
A Map Book of Europe: By A. Ferriday.
The Regions of the World in Pictures: *Set I—Northern Africa*: With Notes by G. J. Cons.
The Need of Uniformity in the Physiographic Divisions of India: By M. B. Pithawalla.
The Educational Review: February, March, April and May 1939.
Indian Co-operative Review: Oct.-Dec. 1938 and January-March 1939.
The Indian Educator: March, April and May 1939.
The South Indian Teacher: March, April and May 1939.
The Geographical Magazine: April, May and June 1939.
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The International Review of the Hungarian Geographical Society: *Vol LXVI*—No. 6-10 (1938).
Quarterly Journal of the Mythic Society: April 1939.
Journal of the Andhra Historical Society: July 1939.
Kalaimagal: April and May 1939.
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The Journal of
The Madras Geographical Association

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The Need of Uniformity in the Physiographic Divisions of India

BY

PROF. M. B. PITHAWALLA, B.A., B.SC., L.C.P., F.G.S.

[*Paper for Discussion, read before a Joint Meeting of Geography, Geology, Physics, Botany and Zoology Sections at the 26th Session of the Indian Science Congress, Lahore, 6th January, 1939.*]

Last year, Prof. Ogilvie of Edinburgh drew the attention of this Congress to the need and technique of regional geography of India, and now that the first attempts at the *regional studies* of some Indian areas by Indian researchers, have been recognised by British geographers[1] and a systematic physiographic division has already been made by me of the province of Sind for my "A Geographical Analysis of the Lower Indus Basin",[1] it is greatly desirable that some kind of uniformity should be adopted in the case of all other Indian provinces and States, in order that there may be no unnecesary overlapping or irregularity at least in the method of division. For, in a recent number of the *Journal of the Madras Geographical Association*,[2] I have found a rather haphazard division of the Tambraparni Basin by Mr. S. M. Das, a Research Student of the University of Madras, and others must be erring similarly while treating other regions of India.

The time, therefore, of drawing the attention of all Indian geographers, through the *Indian Science Congress*, to this vital

1. *Proc. Ind. Aca. Sci.* B. Vol. IV, No. 4, 1936.
2. Ogilvie, Prof., A. G. *The Technique of Regional Geography with special Reference to India*," XIII, No. 2, pp. 110-111.

question of uniformity in the division and classification of physiographic regions of India, is quite opportune. Before it is too late, I wish to point out to all collaborators in the field of Indian geographical research that a method can be evolved, whereby our work could be co-ordinated, all such regions systematically divided and subdivided and the divisions made acceptable to all.

The method adopted by me for my study of the *Indus Basin* is, with slight modifications, that of the Association of American Geographers[3] (*Vide. Ann. Asso. Amer. Geog. Vol. XVIII, No.* 4, *Dec.* 1928) in the case of physiographic divisions of the United States of America. This method is really scientific and closely dependent upon geological investigations; for, while geologists consider " landforms to be a kind of final product or end or effect of geological agencies and physical processes, geographers must needs take them to be a beginning, a point of departure or cause of what nature has in store for man, as its best product ". In fact, everything in nature, vegetable and animal life especially, depends upon the landforms and other physiographical conditions existing in a region. In making a division or subdivision, *homogeneity* is sought, as upon it the value of such a division largely depends. Thereby the physiography, geography and topography of a particular region are together taken into consideration.

Need of Physiographic Divisions of India.

A question may be asked: Where is the need of such physiographic divisions of a country like India? The answer is that there must be some natural physical background for workers in other departments, such as agriculture, economics, industry, sociology, anthropology, etc.

In studying problems of fixing provincial boundaries, of population, of anthropology, of natural resources and water supply, of roads and railways, etc., and in preparing statistics, industrial and others, there is a need of showing *the influence of certain homogeneous physical environment on human life* and of producing such homogeneous units as a background for all kinds of surveys. Before any large schemes, for example of irrigation, trunk roads or railways are prepared, a regional survey of the areas is now absolutely necessary. To give a definite example, if the soil survey

3. *Vide* Fennemen, N. M., "Physiography of Western United States of America", New York, 1938, and 'Physiography of Eastern United States of America,' New York, 1938.

of Sind had been made *before* the Sukkur Barrage Project was taken in hand, the mistake, committed in cutting through a large number of sandbelts of canals, would have been avoided and the consequent problems of seepage and water-logging would not have resulted. Thus any province with its chief physiographic characteristics must afford a setting for the smaller field. Natural resources, such as minerals, salts, etc., must be considered at first, as they are also products of the past geological history of a region, formed under certain physical climatic and other conditions. Agriculture, irrigation, cattle grazing, etc., are all dependent upon these physical factors.

"For geographers", says C. Gillman,[4] "it is probably a foregone conclusion that no human activity, least of all, that of the civil engineer, can divorce itself with impunity from geographical facts and geographical thought. To the multitudes, who work at their daily routine in field and office, however, this idea is not so obvious and they constantly overlook the fact that *without geographical insight, they are liable to heap blunder upon blunder in perfect professional innocence*".

Now, a geographical survey of any region must necessarily take full account of its physiography, and therefore the divisions, made of India on a basis other than physiographic, must be highly defective and narrow in outlook.

There is a movement ahead of fixing the provincial boundaries of India on a linguistic basis. If geographers can also help politicians to solve such problems, they will render valuable services.

Thus systematic physiographic divisions of India, irrespective of political boundaries, are absolutely necessary, especially in our country and in these days, when many *All-India* schemes are put forth.

Basis of Division.

In making a division of any region, the most prominent elements of physiography are to be considered:—

(1) *Structure*:—The result of geological agencies including the nature of rocks and their initial stage, before erosive agents act on them.

4. Gillman, C., "Geography and the Civil Engineer," *Scot. Geog. Jour.* Vol. 53, July 1937, p. 242.

(2) *Process* :—The destructive agencies, including climate, to produce its effect on the original structure, the erosion actually depending upon the structure and the forces at work.

(3) *Stage* :—The cycle of changes taking place during the process of erosion on the original structure, e.g., folded rocks have the folding persistent in the landscape of a region.

Thus the most outstanding characteristics of an area to be considered for our purposes are those which even a careless traveller might find in it, as its topography, influenced by its climatic peculiarities.

Prof. Ogilvie has very emphatically pointed out the defect of a lack of any systematic description of Indian land-forms by the Geographical Survey.[5] This defect has to be remedied by us, geographers, who belong to the Section of Geography, Indian Science Congress.

For, this new science of land-forms, I refer our Members to the newly started Journal of Geomorphology (Publication by the Columbia University Press). I wish Indian geographers give their share and contribution to this excellent research, to enable us to produce a most accurate division of our land.

Difficulties of making Physiographic Divisions.

There are some inherent difficulties in making physiographic divisions of India :—

(1) *Co-ordination And Want of Organisation* :—In our country, we have nothing like an All-India Geographical Association to co-ordinate the work of various geographers. Even the Indian Universities do not seek any kind of co-operation in the matter. In fact, the geographical science is just in its infancy in our country. There are only a few centres, where geography is properly studied. By some Universities it is not even recognised as a branch of Science. It is only to the newly started Section of Geography, under the auspices of the Indian Science Congress, that we can look forward for a solution of this difficulty. I, therefore, suggest that until the formation of an All-India Geographical Association, all problems and difficulties in connection with geographical research should be referred to this body. The first thing to settle is this problem of the Division of India.

5. Ogilvie, A. G., Op. Cit., p. 113.

(2) *Political and International Boundaries*:—Commenting upon my work on Sind, *A. G.* in a leading geographical magazine,[6] remarked: "It is a pity that a geographer free to go beyond administrative boundaries should allow himself to be hemmed in by these. The area described is not strictly the Lower Indus Basin but that part of it included in the province. Similarly the limits of the author's 'Physiographic regions' sacrifice the 'homogeneity' he claims for them by sometimes following administrative bouhdaries. An official may not be authorised to make estimates outside his departmental area, but to do so is the non-official research worker's opportunity."

It is a great pity that in our country the help needed by a research worker in a particular region is not soon and willingly forthcoming and he is greatly handicapped for want of data beyond a certain political limit. Cordial co-operation between various provincial government departments is sadly lacking. There is red-tapism, considerable delay and downright discouragement given by a certain class of officials in this country.

It is also impossible to obtain any reliable data from the neighbouring parts of Sind, such as the Kalat, Las Bela and Rajputana States.

Besides, most of the Indian Government and Native States reports, including the Census Reports, are by provincial districts. A pioneer, particularly in the field of regional geography in India, is, therefore, hemmed in by political and international boundaries, in this matter of collecting the necessary information. I had, therefore, no other alternative but to take Sind equivalent to the Lower Indus Basin.

(3) *Physiographic Boundaries To Define*:—Another real difficulty is that of defining exactly the boundaries of physiographic divisions of India, there being very imperfect geological surveys in certain parts, and literature being hard to secure and some of the Memoirs and Records being out of print or out of date. If, therefore, we cannot actually draw such boundaries on the ground for the present, we shall have to be satisfied even with some theoretical boundaries for the present. It is only with the help of local collaborators that this difficulty can be surmounted to some extent.

(4) *Naming of Divisions*:—Apart from defining the boundaries, the task of giving appropriate names to the different divisions

6. *Jour. Scot. Geog. Mag.* Vol. 54, No. 4, July 1938, p. 244.

will not be easy. As in the case of the American researchers, it is possible for our purpose to take the most prominent representative characteristic of a division, a prominent place name or an *important river or town in a particular division or sub-division. e.g.*, Southern Plateau Land, which includes river valleys of South India as well.

Physiographic Divisions to Supersede "Natural" Regions

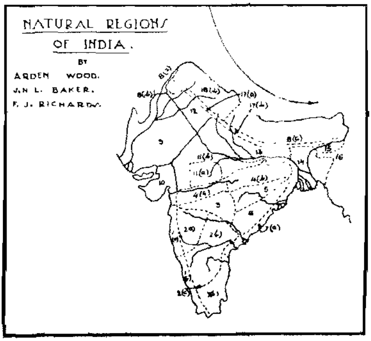
Hitherto India has been roughly divided into so-called natural regions by a few British geographers without any regard to geomorphology and other local conditions. There has been nothing definite about their mode of division and there is no uniformity. Rather, there is much confusion and overlapping of boundaries. It is suggested that once an *authorised physiographic division of India* is made, such natural regions, as are haphazardly made, should be discarded by all Indian geographers, and *uniformity* both in the manner of division and nomenclature should be sought.

The following Natural Regions of India (see Sketch Map of India showing the same) are referred to as such an example of divisions, hitherto made :—

The "Natural" Regions of India.

J. N. L. BAKER AND OTHERS	DUDLEY STAMP.
1. West Coast	14. West Coast.
(*a*) North	(*a*) North.
(b) South	(b) South.
2. Deccan Region	21. Deccan Lavas Region.
(*a*) Bombay Deccan	21. Deccan Region Proper.
(b) Deccan Southern	
3. Higher Plains of Berar and Nagpur.	(Western part included in the Deccan Lavas Region. Eastern part in Godaveri Valley).
4. Central Highlands	Included in the Deccan Lavas.
(*a*) West.	22. (*a*) Central Indian Highland.
(*b*) East.	(*b*) Chota Nagpur Plateau.
5. Chattisgarh Plain.	22. (b) Chattisgarh Plain.

J. N. L. BAKER AND OTHERS	DUDLEY STAMP
6. Berar-Orissa Highlands.	22. (*c*) Eastern Ghats Region.
7. East Coast (*a*) North	16. Northern Circars Region.
(*b*) South	15. Tamil Region.
8. N. W. Frontier Region	5. N. W. Dry Hills Region.
9. The N. W. Dry Area	7. Lower Indus Valley of Sind.
	17. Thar Desert.
	8. Punjab Plains (part)
10. Kathiawar and Gujrat. (Transition between dry regions of Sind and wet ones of the W. Coast).	13. *Kathiawar and Gujrat.*
11. Aravalli-Vindhya Uplands.	18. The Rajputana Uplands.
12. Indo-Gangetic Plain West.	8. Punjab Plains (part).
13. Indo-Gangetic Plain East.	9. Upper Ganges Valley.
14. The Delta Lowlands.	11. Lower Ganges Valley or Deltas Region.
15. The Assam Valley.	12. The Brahmaputra or Assam Valley.



J. N. L. BAKER AND OTHERS	DUDLEY STAMP
16. N. E. Hill Tracts.	1. The Eastern Hill Region.
17. The *Sub-Himalayan* Region.	3. The *Sub-Himalayan* Region. (*a*) Eastern. (*b*) Western.
18. The Himalayan Region. (*a*) Eastern. (*b*) Western	2. The Himalayan Region. (*a*) Eastern. (*b*) Western.
(Not included here)	4. Tibetan Plateau. 6. Baluchistan Plateau.

There is considerable overlapping of boundaries and uncertainty of homogeneity in the above,[7] though, on the whole, the divisions made by Dr. Dudley Stamp are more rational and welcome. as they are pioneer attempts.

Last year, Dr. S. P. Chatterjee of Calcutta prepared another sensible paper for our Congress, on the "Natural Regions of India," but based his classification not on physiography and geomorphology, but on forest flora, surface relief and climate. The soil, derived from parent rocks, is also a most important physical factor of such a classification and cannot be easily ignored. So, without any co-ordination in this matter. there will be a great loss.

Method of Division of India Proposed By Me.

The method. proposed by me, of dividing the land into regions, is mainly physiographic, as the physical basis is the chief criterion as stated above; that is to say, the *principal* divisions are made according to the geology and topography (rocks, drainage etc.) as controlled by the internal and external agencies working on them. Minor physical features are subordinated to the main features.

The findings of allied sciences, such as botany, zoology, meteorology etc., are next to be considered, while making Sections and Sub-Sections of the major Divisions. Local differentiations, such as belts of forests, grasslands, barren lands, rainshadow areas, marshes, etc., are to be ignored while dividing the country into the *principal* physiographic regions, which should be homogeneous masses of lands within which life, both animal and vegetable, must exist more or less uniformly.

7. "*Geography*," Vol. XIV, 1927-28, pp. 44 ff.

Proposed Physiographic Divisions of India.

I now give below my own scheme of producing physiographic divisions of India for their acceptance or criticism by the Congress. (*see Map of India, showing Divisions*). India is most naturally rendered into 3 chief *Divisions*, viz.

(1) Extra-Peninsular Mountains.
(2) The Indo-Gangetic Plain.
(3) The Peninsular Area.

These are, then, divided into *Provinces* (marked I, II, III, etc.) according to the chief physiographic characteristics of each, especially the erosional histories of the region. These Provinces are again subjected to 40 smaller divisions, called *Sections* (and marked A.B.C. etc.) according to the stage to which a particular land-form is reached, and other *chief* natural characteristics noticeable.

It is also possible to make sub-divisions of these *Sections* and entitle them Sub-Sections, on the same principles, *e.g.*, laterite caps of the Deccan Trap Region, forest belts on the Western and Eastern Ghats, the Tambraparni Valley of the Tamil Section etc. But for want of time, I have omitted them.

(1) EXTRA-PENINSULAR MOUNTAINS

I. WESTERN HIGHLANDS

A. *Khirthar Mountains.*—Dry and folded ranges of mountains nearly 6,000 ft. Little rain and no soil. Considerable subaerial denudation, forming small plateaus. Mostly Tertiary rocks with poor drainage, and merging into the Iran Plateau.

B. *Kohistan Section.*—Lower ranges with slightly more rainfall. Subaerial denudation is greater, with resulting long anticlinal valleys in which a little soil is cultivable. Many hot springs of Sind.

II. GREATER HIMALAYAS.

A. *Northern Himalayan Section.*—Snow-covered mountains with highest peaks. Leeward side merging into the Tibetan plateau. Alpine flora in some parts. Older rocks are exposed due to the action of ice, etc.

B. *Southern Himalayan Section.*—Wetter parts, receiving the force of the Indian monsoon. Sources of most of the North-Indian rivers. Temperate forests in parts. Newer and highly contorted rocks outcrop in places.

III. MIDDLE HIMALAYAS.

A. *North-West Dry lands.*—Hot and dry region; very hot summers and very cold winters.

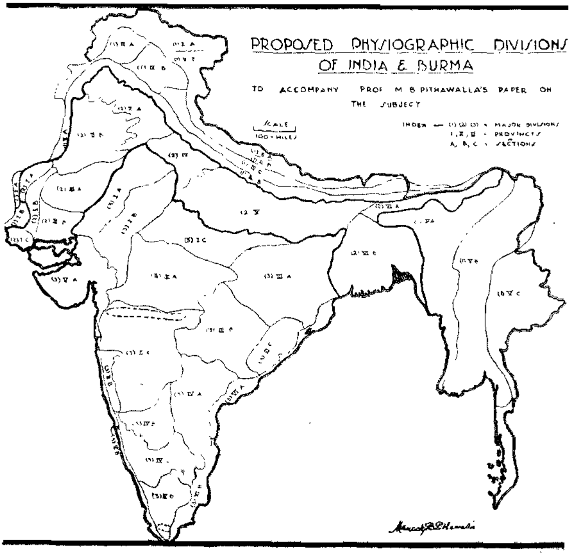
B. *Kashmir Valley.*—Lying between ranges of mountains, 15,000 to 20,000 ft. A most beautiful Dun or Valley, strewn over with lakes and cut by the Jhelum. Mountain passes. Forests on the northern side of mountains. Rainfall average 25″. Snow melt in summer below 16,000 ft.

C. *Himalayas Proper.*—Snow-line 16,000 ft. Complex geology with thrust faults etc. Crystalline Complex.

IV. SUB-HIMALAYAN REGION.

A. *Frontier Section.*—Largely occupied by the Nepal and Bhutan States. Newer and unstable rocks.

B. *Siwaliks Section.*—Hot and dry with 20″ of rainfall. Ht. below 10,000. Sub-tropical forest, evergreen and coniferous. Hill stations of Northern India. Foothills of the Himalayas, formed of detritus brought down by the rivers (Siwaliks).



V. EASTERN HIGLANDS.

A. *Assam-Burmese Yomas.*—Heaviest rainfall in India. Tropical forest land, covering Tertiary rocks.

B. *Irrawadi Basin.*—Broad and deep valleys. Rice land 80″ rainfall. Oil wells in Tertiary folded rocks.

C. *Shan Plateau.*—Tableland with moderate monsoon current. Forests grow.

(2) INDO-GANGETIC PLAIN

I. LOWER INDUS VALLEY.

A. *Western Valley Section.*—Old alluvium. Seasonal hill torrents and springs. Rich drift soil. Floods common. Little rainfall.

B. *Eastern Valley Section.*—New alluvium. Old river channels and shifting banks. No springs. Irrigated and cultivated lands. Variable rainfall.

C. *Indus Deltaic Area.*.—Uncultivable, swampy and sandy in parts. Changing mouths of the river. Rice cultivation only. Hydrographical changes.

II. UPPER INDUS VALLEY.

A. *Potwar Section.*—Higher ground upto 1,000 feet and little rainfall. The Salt Range the most prominent feature, a field museum of Indian geology. The Soan valley a relic of the Indobrahm.

B. *Punjab Plain.*—Cut through by the Punjab rivers. Good and deep drift alluvial soil. Wheat lands of India. Rainfall upto 25″, including winter showers. Many hydrographical changes.

III. DESERT PROVINCE.

A. *The Pat Section.*—Covered with clay or silt and with longitudinal Bhits or sandhills. Dhands or salt lakes in the valleys. Outcrops of Jurassic rocks here and there.

B. *The Thar Section.*—Sea of sandhills. Rainfall slightly better.

IV. UPPER-GANGES VALLEY.

A. *The Doab Section.*—Best irrigated and highly cultivated land. Flat and fertile. Contains patches of *usar* or *reh* (salt) deposits,

B. *Rohilkhand Section.*—Damper and wooded country with little salt deposit. Rainfall upto 40″. Plain sloping from Delhi (700 ft.) to Allahabad (400 ft.)

V. MIDDLE-GANGES VALLEY.

(*No prominent Sections are possible*).—Damper than the Upper Ganges Valley, with rice crops more important than wheat ones. Thickly populated. Rainfall 40″ to 60″.

VI. LOWER GANGES VALLEY.

A. *The Brahmaputra Valley.*—On the leeward side of the Assam hills. Less rain, but damp soil. Higher levels.

B. *The Ganges—Brahmaputra Plain.*—Fine, silty and flat region. Most thickly populated land in India. More than 60″ rainfall. Full of Sunderbans.

C. *The Ganges Deltaic Area.*—Marshes, enclosing swampy islands, making the places unhealthy. Parts are under water during rains. Old water channels cut off.

(3) THE PENINSULAR

I. RAJPUTANA UPLANDS.

A. *North-Western Section.*—Sandy wastes. Poorly watered. Marwar harbouring migratory people.

B. *Mewar Plain.*—Morphologically varied. Typically irregular gneissic plain. Outcrops of Dharwar rocks with rich mineral deposits. Heart of Rajputana.

C. *South-Eastern Section.*—Pathar and Uparmal, a triple plateau of concentric scarps of Vindhyan sandstones.

II. DECCAN TRAP REGION.

A. *Central India Tableland.*—Full of Deccan Trap, Vindhya and Cuddapah rocks.

B. *Western Ghats.*—Highest parts of a denuded tableland. Very good rainfall and forested on slopes. Trap area prominent.

C. *Bombay Deccan.*—Leeward side of the Ghats. Less rainy and thinly populated. Black cotton soil. Laterite caps prominent.

III. NORTH-EASTERN TABLELAND.

A. *The Mahanadi Basin.*—Complex group of Archaean, Cuddapah, Gondwana rocks, coal and iron deposits. Rainfall 40″ to 60″.

B. *The Godavari Basin.*—Gondwana System of rocks with coal and iron deposits. Less rainfall 30" to 40".

C. *The Eastern Ghats.*—Unevenly denuded Archaean rocks of good height. Rainfall 60" to 80" including the N. E. Monsoon current.

IV. SOUTHERN PLATEAU.

A. *Cuddapah Section.*—Rocks of the Cambrian-Silurian Age. Thin rocky soil. Effects of retreating monsoon.

B. *Bellary District Section.*—Scrubland. Rainshadow area. Cotton grows with less than 20" rainfall. Low levels.

C. *Nilgiri Hills.*—Dharwar rocks, rich in minerals. Good rainfall. Good slopes for tea plantations.

D. *Tamil Section.*—Archaean rocks of considerable denudation. Double monsoon and good cultivation in the valleys of the southern rivers.

V. WEST COAST PROVINCE.

A. *Northern Section.*—Gujrat-Kathiawar coastal plains. Low lands with hills here and there. Variable climate and getting drier and drier, as we go northwards. Good black cotton-soil, derived from parent rocks of the Deccan Trap family. Component parts under diverse conditions. Migratory character of the people.

B. *Southern Coast land.*—Very well watered and lying between the Ghats and the Sea. Few natural harbours; e.g. Bombay. Unbroken coast-land. Sandbanks with cocoanut trees and flat alluvial rice land behind. 80" rainfall. Facilities of coastal services.

VI. EAST-COAST PROVINCE.

A. *Northern Coastland.*—Outcrops of older rocks here and there. Godavari and Krishna delta-land included. Double monsoon with rainfall nearly 40". Forested on hillsides.

B. *Carnatic Section.*—Mainly alluvial tract with hills of Archaean rocks in between. N. E. monsoon rainfall good. Unbroken coast with a few ports.

Summary.—Now that Indian geographers have begun taking interest in the regional geography of India, I think it is absolutely necessary that our work should be co-ordinated in regard to the physiographic divisions at least. I have already adopted, with suitable modifications, the method of physiographic division, em-

ployed by the Association of American Geographers, for my pioneer regional study of the Lower Indus Basin (Sind). (*Proc. Ind. Aca Sci.* B. Vol. IV. No. 4) and as I have found it quite suitable for our country, I am advocating it as one, which other workers in the field, may utilise with advantage, in order to avoid any overlapping or confusion of boundaries etc. There must be uniformity and homogeneity in the divisions of our country at any rate.

Such physiographic divisions, uniformly made, would be of immense scientific value, as a most reliable background for other surveys, such as those of agriculture, industry, economics, water supply, population etc. They will be, in fact, in great demand from Government, Municipalities, Corporations and other departments.

I realise the difficulties of producing a satisfactory division of India into physiographic regions, e.g., political or administrative boundaries, naming of divisions, study of land-forms and departmental reports or blue books, but they can be solved if an All-India Geographical Association is established.

The so-called 'natural' divisions of India made by previous workers in the field, should now be superseded by *systematic physiographic regions*, approved by such a responsible body, as I have suggested.

Applying the triple principle of structure, process of erosion and present state of land-forms, affected by subaerial agencies, I have prepared a map of India and Burma, showing 3 Major Divisions; 17 Provinces and 40 Sections.

For preparing minor Sections and Sub-Sections, the factors of vegetation, animal life etc., may be considered.

It is hoped that these divisions will be found satisfactory and adopted by other collaborators in preparing monographs on regional geographies of our country.

Reply to Critics.

I must say at the outset that the Members who took part in the Discussion should not have lost sight of the fact that all I have sought to be done by the Science Congress is to secure *uniformity* in the divisions of India, so that our geographical researches may be properly co-ordinated. There is no intention of mine to seek

any innovation and to impose it upon others. I must object to the statement made by a Member that "*mere geographers*" cannot and must not solve the problem satisfactorily, while the fact is that geography, as a Science, does take into account the findings of the allied sciences, e.g., Botany, Zoology and Meteorology. My point is that the *chief* parts of the country, (not only the 3 Major Divisions but also the 17 Main Provinces at least will have to be fixed *physiographically* as I have suggested, because the physical basis is and should be the criterion in such a case :—

3 Major Divisions.	17 *Provinces.*
(1) Extra-Peninsular Mountains.	I. Western Highlands.
	II. Greater Himalayas.
	III. Middle Himalayas.
	IV. Sub-Himalayan Region
	V. Eastern Highlands.
(2) Indo-Gangetic Plain.	I. Lower Indus Valley.
	II. Upper Indus Valley.
	III. The Desert Province.
	IV. Upper Ganges Valley.
	V. Middle Ganges Valley.
	VI. Lower Ganges Valley.
(3) Peninsular India.	I. Rajputana Uplands.
	II. Deccan Trap Region.
	III. North-Eastern Table-land.
	IV. Southern Plateau.
	V. Western Coast Province.
	VI. Eastern Coast Province.

The resultant of various other forces will be considered and everything will be taken into account, when fixing *details* about the minor subdivisions. That is why we have allowed the Discussion to be held under the *joint* auspices of the five Sections of the Congress, so that we may come to some reasonable agreement.

It is also argued that physiographic divisions of India would only be superficial without regard to the botany, zoology, climatology, etc. But on the contrary, in my opinion, they will be most natural and fundamental. The main Divisions, proposed by me, are based on geology, geomorphology and climate and they must be fixed *uniformly in the first place.*

The points, raised by my opponents as regards the inclusion of the factors of vegetation and other natural and local types, would

surely come in while fixing the Sub-Sections and also the exact boundaries of the regions. Minor differences, such as those pointed out, e.g., Forest belts etc., are to be ignored while fixing the *main* Provinces and Sections, as indicated by me. Also, homogeneous masses of land should absorb small features.

Besides, in a country like ours, with many chance-political divisions and States, and so much harmful provincialism, it is necessary and safe to take up the regional studies of India by physiographical, (that is the most natural) and not by political or other artificial considerations.

I must repeat here most emphatically that the problem of uniformity and homogeneity in the Division of India, is very urgent and cannot be indefinitely put off. Unless it is solved by all of us satisfactorily now, much energy of research workers in Indian geography will be wasted and we shall not do credit to ourselves.

Fisheries of Cochin *

BY

A. KARUNAKARA MENON, B.A., L.T.

The small, almost maritime state of Cochin lies between the 9th and 11th degrees of North Latitude and the 76th and 77th degrees of East Longitude, and covers an area of about 1361½ sq. miles. It has as its western boundary the vast Arabian Sea with a coast line about 35 miles in length. Bordering on it is a flat swampy belt rich with evergreen cocoanut palms, and between this low belt of land and the mainland, lies a continuous sheet of water, more than 35 miles in length, extending north to south, with a depth varying from three to sixty feet. There are at some places large lagoons between the sea and swampy belt, separated from the sea on the western side by mud banks overgrown with moss and weeds. The backwaters running parallel to the sea open out into it at two points—at Azhikode (near Cranganore) in the north and at the Island of Vypeen in the south. The backwater area is connected with the inland by two main rivers, the Chalakudi and the Alwaye, and numerous canals and channels. During the South-west Monsoon these rivers and minor streams bring with them enormous quantities of debris, mud and alluvial matter, besides a large volume of water. At this season of the year the backwaters (and even the sea to about a mile from the shore) lose their salinity to a certain extent.

The waters of Cochin are full of different varieties of fish. But much of this potential wealth of the State still remains unexploited, and fishing as an industry is still in its infancy. Much has yet to be done before it can stand comparison with the fishing centres abroad.

The fisheries of Cochin can be roughly divided into three classes—marine, brackish water and fresh water. Marine and brackish water fisheries are the most important. Fresh water surfaces of the State do not yield much at present, though excellent conditions exist for large scale stocking of fresh water fishes.

* Paper read at the Geography Section of the Indian Science Congress, Lahore Session, January 1939.

Marine Fisheries.—Sea fishing on the West Coast, particularly in Cochin, is still in its primitive stage. People engaged in it as their life-work are having only a hand-to-mouth existence, with long intervals of unemployment and starvation caused by bad weather and irregularity of fish visitations in the shallow regions accessible to the fishermen in their frail crafts. A good deal has to be done in improving the condition of fishing as well as in that of the fishermen.

Most varieties of tropical climate fishes are to be found in the sea here. From small one-inch 'Kozhuva' to big sharks 20 to 25 feet in length, most varieties of scaled and unscaled fish are to be got in their respective seasons. The more common varieties, however, are the sardines and mackerel fishes, which are found almost throughout the year, especially in summer months. Other varieties of small sea fish such as 'Kurichil,' 'Thody,' 'Kuri' and prawns are mainly seasonal fishes and are used mainly for food. Another species known as the 'Pampada'—a flat bodied snake-like fish is got on the high seas in increased quantities as we go southwards into Travancore waters. The peculiarity of this fish is that it can be easily dried and preserved for long, so that it can be exported to distant places. Among larger varieties may be mentioned the Tiger fish, the Arkya, the Kadal Karup, and the Kola which at their best weigh about 50 to 70 lbs. and afford excellent material for food. Occasionally these are seen in the inland brackish waters also. Different varieties of sharks and porpoises abound in the western seas, especially in the deeper regions about 10 miles off the coast, the utmost limit that fishermen of Cochin would go. The fishermen of Cochin are poorly equipped with materials to trap these big fishes, many of which grow to 15 to 20 ft. in length. But by sheer accident sometimes they happen to lose their way into the flimsy nets and get caught. In Travancore and British Malabar fishermen are more successful with these fishes. The 'Adakam Koti' net made of wiry rope to a length of about 2000 feet is the favourite device of Travancore fishermen. Being an expensive concern employing about 20 to 30 boats and over 300 men at a time, it has become a capitalistic venture, where the actual worker gets the least. The Muslim fishermen of North Malabar are far more successful and less exploited than their southern brethren. Such is their skill that their success is popularly ascribed to some black art.

Cochin fishermen are more successful with these fishes when they happen to get into the brackish waters and lagoons. But the porpoises are protected by law in these areas. It is said that the

Dutch, while they were in power in Cochin depended on the porpoises to do dredging in the harbour area, and hence made it penal to catch them there. The sharks are noted for their food value as well as fat. A variety of shark with a double edged saw-like horn on its head, sometimes measuring nine inches in width, and three feet in length, is the one particularly prized. It is a dangerous game to hunt them, for its saw can be fatally turned against the adversary. Cochin fishermen irrespective of caste or creed dedicate themselves to St. Peter the fisherman and start upon the game during the most rainy parts of the month of June, when the feast of St. Peter falls. Rope nets are cast in which the saw of the fish is entangled, and after a regular fight lasting for hours the fish is killed and dragged ashore, where the brokers and middlemen settle the price, and the ceremonies and formalities of cutting him up begin. A full grown fish it is said would fetch something between Rs. 150 and 200.

Brackish Water Fisheries :—The backwaters and lagoons lying contiguous to the sea and connected to it by openings, abound in numerous varieties of fish. Most varieties of sea fish are found here, including even some of the large species. But there are some very prolific varieties special to these waters only. The 'Karrampa', Kathiran', 'Katla', 'Nata' etc., are small but fleshy varieties which can be had at all seasons. The 'Thiratha,' a pretty big variety weighing about 10 lbs. is a monsoon season fish available in abundance for about three months of the year. A pair of its eggs which would weigh about 1½ lbs. and fetch about 8 to 12as. has always a ready market outside.

But the most important of the brackish water fishes is the prawn, which is more a jelly than a fish. The ever-keen demand for it from the markets of Burmah and neighbouring places has proved the best encouragement for prawn fishing, which is admittedly managed best in Cochin and Travancore than any where else. Many of the ricefields bordering on the backwaters are used as part-time fisheries. Soon after the harvest the fields are filled with water and closed up. Prawn sperms happen to be in the water and soon they develop. They become mature in 30 to 35 days when the water in the fields are drained through sluices opening into nets at ebb tide. When once the prawns are transferred into the nets, the fields are again filled at high tide and closed up for another prawn harvest.

Perhaps included in the prawn family is the blue lobster which is a North-east Monsoon visitor of the backwaters. Though got in

plenty it has not any commercial imporance. It has only a very limited food value.

Fresh Water Fisheries.—The scope for fresh water fishing is very limited in Cochin. But in Travancore it is not so. The rivers of Travancore abound in many varieties of fish. But both in Cochin and Travancore fresh water fishing is resorted to only to meet exigencies of local consumption. Some of the common fishes found here are the carp, 'Veral' 'Puttuthi', 'Karimeen', 'Kuri', 'Velluri', 'Kayal Chemmin', etc. The crude methods of fishing resorted to in these fresh water areas like poisoning are highly detrimental to the fishing industry. The waters are being depleted day by day, while no attempt is being made to rear at least the rare varieties. Both in the fresh water and brackish water areas there is ample scope for increased production on well-planned lines. The capture of fish when they are with eggs is a destructive process and has to be stopped. Several varieties can be bred in special localities and their output increased. The example of Japan is well worth imitation in this respect.

Fishing Communities.—Valans and Arayans form the important fishing communities of Cochin. Fishing and boat service have been their traditional occupations. Till recently they have been enjoying great privileges in the State both social and political and the headmen of the community wielded great influence and authority. Many of the Muhammadans and Christians who have taken to fishing as their occupation are said to be converts from the above-mentioned Communities. As has been pointed out elsewhere a great deal has yet to be done to improve the economic and social condition of these fishermen, many of whom are entirely dependent on middle-men. If India is to have a navy it is undoubted that a good percentage of the man power required to work it will have to be recruited from fishing folk such as these, so that the quality of human stock among them deserves to be well preserved even in the interest of national defence.

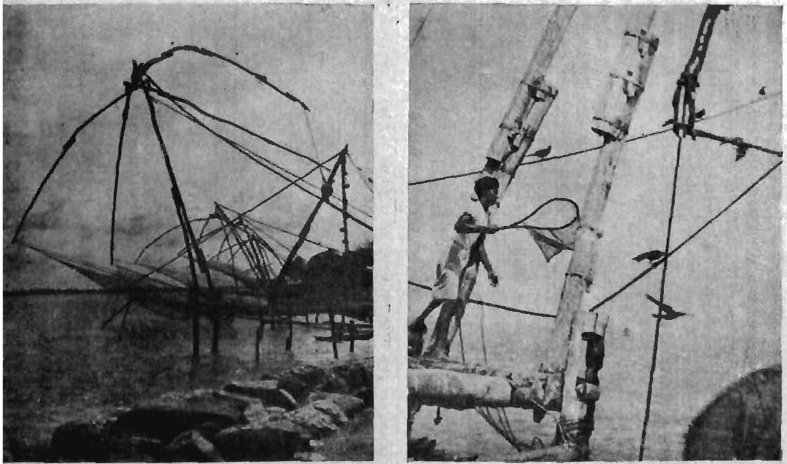
Methods of Fishing.—Of the methods adopted in fishing in the State the most common is fishing with nets. Nets vary in size and shape. In the backwater areas the one that is commonly used is the stake-net. In selected sites stakes are planted in the water in rows, ranging from 10 to 200. The place where the stakes are planted are called in Malayalam "Oonni Padus," the oonni padus being leased out. Nets made of cotton and coir in the shape of long conical bags narrowing to the tail and held up by means of hooks are fastened to the stakes. The tail-end is opened and is

tied by means of a rope. The prawns and other fishes that enter the nets become packed up and are unable to go back. The catch is later on emptied into a boat through the tail-end which is then untied. Other kinds of nets used in the backwaters are, as they are called in Malayalam. "Kandali," 'Narimeen Vala', 'Chavitto Vala' 'Vati Vala,' 'Veesu Vala,' and 'Kona Vala' etc. A vala simply means a net.

Another interesting one is the 'Cheena' Vala (China net) with an elaborate frame-work by means of which the net is suspended and let down into the water like a bucket and drawn up again after a few minutes. The name 'Cheena Vala' is a misnomer, the net being only a Portuguese introduction. Even now its various parts are known only by Portuguese names. The name 'China net' was given to it only out of the old practice of ascribing everything, new or curious, to Chinese origin.

Another ordinary method is fishing with rod and line in small boats in the backwater and in the margin of the sea. Generally prawns are used as baits.

Fishing by the help of series of missiles is also a common feature in the waters of Cochin. Kudumbi fishermen venture far out into the sea by about dusk and harpoon the sharks with their 'Chatturi'. 'Thumbithan' is another implement used. It is a long narrow tube about ten feet long with a sharp dart attached to a long string inserted into it. The experienced fishermen on seeing a fish shoot the dart by blowing the tube and the dart strikes the fish, which is gradually drawn out. Ordinary bows and arrows are also used by some people to capture fish. Spearing the fish with the help of a weapon called 'Mupalli' is a common practice in the backwater. When it gets dark fishermen walk along the shore close to the waters with blazing torches held aloft in the hand and with a scythe in the other. The fish is lured to the surface by the light and then the fishermen strike at it with their scythes. 'Ottal' is another common implement used. It is made of finely split bamboo in the shape of belly-jar with a wide-mouthed bottom and a narrow open neck. Fishermen go with this in one hand and a torch in the other. When the fish is lured to the surface they plunge in the implement suddenly into the water and the fish found inside are taken out by the hand through the narrow opening. Numerous other methods of catch also are in vogue-like dissolving certain poisons in the water to kill the fishes; causing dynamite to explode under water; etc. But these are all



CHINA FISHING NETS—COCHIN.

thoroughly destructive methods and should be discouraged in the interest of the fishing industry. If fishing is to thrive as an industry, scientific methods adopted in countries like Japan and Norway have to be studied and copied here. The wealth of the deep sea has yet to be explored by trawling and other scientific methods. Trawling was once attempted in the sea here but had to be given up for want of the facilities to dispose of the large quantities of fish caught. An export market can be created and the trawler reintroduced.

Catch How Disposed of.

The majority of the population of Cochin, Travancore and Malabar—all except high caste Hindus are fish-eaters. Fish, where available, is an invaluable element in the diet of a rice-eating population. The masses especially the extremely poor people consume every kind of fish that comes in their way. 'Sardine' occupies almost the first rank in respect of food value and it is the cheapest of all. But the pity of it is that by the time they are taken inland for consumption they become tainted and many people content themselves with such tainted fish food. Fresh fish supply to the interior parts of the country is an imperative necessity and unless ways and means are found out for these there cannot be any improvement in the dietary of the people. Tinned Sardines from Norway and Japan fetch very high price even now in Indian markets. In point of quality our Sardine is superior to the Norway variety which is deemed the best. But with all that, we have to import foreign stuff because scientific methods of preserving fish are not resorted to here. With only a few thousands of rupees as capital it is quite possible to organise business lines and secure for our sardines a high and a certain place in the world market. The late Sir Frederick Nicholson of the Fisheries Department had a canning industry established at Calicut for instructional purposes. It has not been availed of for lack of propaganda.

In other ways also sardines have special value. It is an excellent manure especially for the cocoanut palm. In its best season, when supply far exceeds normal demands, it would sell dead cheap and cocoanut growers make capital out of the situation. Sardine oil is another valuable yield. It has recognised medicinal and dietic values. But no organised attempts have been locally made to benefit thereby. Sardines are boiled in big cauldrons from which the oil is skimmed off and the

residue is used as manure. The common use the oil is put to is to varnish the native boats thereby to enhance their durability by keeping them water-proof. Messrs. Stane & Co. devised a mode of pressing out oil from sardines and started a sardine oil business. But Japanese sardine oil came in and undersold the local product.

Fish-curing and drying on primitive lines are done by various private agencies. Under the auspices of the Government attempts are being made to improve these methods and if they prove successful a big trade in fish may follow. The Travancore Government have of late started refrigeration as a mode of preserving fish, making cycle deliveries weekly from ice-packed box. But it has met with violent opposition of local fishermen who resist change. Should it succeed, Malabar fish may find markets farther afield than Malabar. The fins of the shark are priced as a great delicacy in Burma and China, and have been exported thither in large quantities from of old. The Travancore Government are now making experiments whereby shark oil may be put on the market in competition to cod-liver oil.

Fish manure either as sardine stuff or prawn scales is having a good market locally, but if scientifically prepared it can surely command a wider market. In the same way sea-shells, fish-bones, etc., can be put to various uses like button-making. Oyster-fishing affords scope for a very big industry and trade. Oyster shells baked in kilns and powdered afford excellent mortar for building purposes. Large quantities of this used to be exported to Bombay and other places, but due to unbusinesslike methods the trade has to be confined to local areas only.

Prawn industry is said to be the most thriving industry in these parts. As soon as they are caught from backwaters or fields they are boiled and dried in the sun. When dried they are peeled off their skin by being put in sacks and beaten on the ground. The peeled skin is a good variety of manure. The inner pulp is a delicious food in some markets especially in Burma, and sometimes fetches over 375 rupees per candy. Under favourable conditions one acre of paddy field may yield about 800 rupees worth of prawn, so much so that people who know how to do so often neglect paddy cultivation in favour of prawn breeding.

Recent Irrigation Changes in the Cauvery (Tanjore) *

By

T. Krishnaswami, M.A., L.T.

In this paper an attempt is made to survey the Mettur or the Grand Anicut Canal region in the Tanjore district and to note the effects of the Canal on the area in all its varied aspects. It is barely five years since the Canal has been functioning and it is rather too early to gauge with any finality the full consequences. In the absence of reliable statistical data, it will only be possible to indicate the general tendencies which have been deduced from the facts noted and observations made of the region in question during these few years. As and when fuller statistical information is made available by the various departments of Government, it is proposed to supplement or modify, if necessary, the conclusions arrived at which, in the nature of things, can only be tentative.

Considerable stress is often laid by Indian financiers on the fact that "Indian finance is a gamble in rains". The full force of the statement could be appreciated only when the reactions of a flood or a drought on the agricultural life of the country is envisaged. Where the uncertainties of Nature are so great, man tries to minimise the risks involved by conserving rainfall in reservoirs. The storage in addition to avoiding flood-risks involved in times of heavy rainfall makes the surplus water so stored available in seasons of drought. Moreover regions deficient in *natural* rainfall and devoid of other irrigation sources could be benefited by the canals carrying water from the reservoir to the fields. But before the costly method of Reservoir-cum-Canal irrigation is attempted, proper utilisation of the run-off or surface drainage is necessary. This is a cardinal principle that should be recognised and borne in mind by all engineers before launching on any irrigation project.

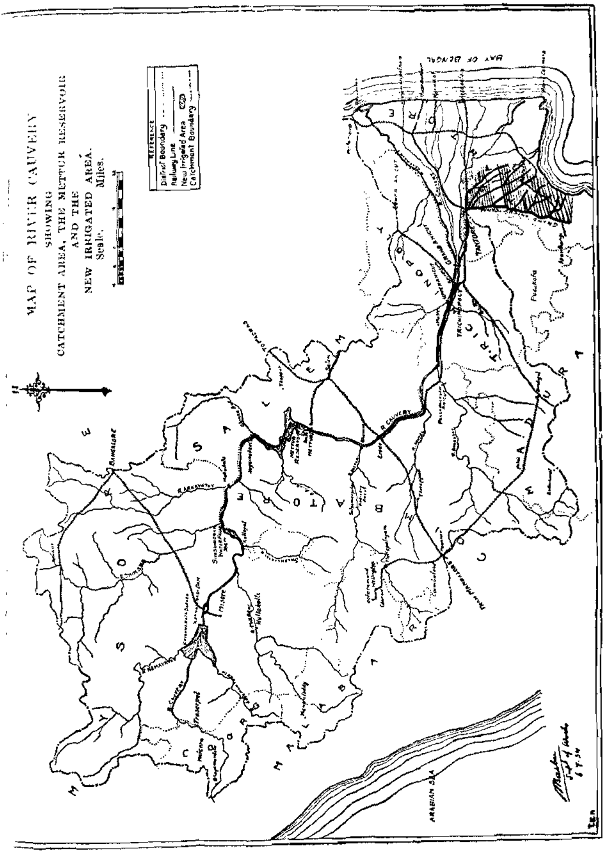
The main conditions imposing a limit to the extension of irrigation are:—(1) the geographical and seasonal distribution of

* Paper read at the Geography Section of the Indian Science Congress, Lahore Session, January 1939.

the rainfall; (2) the configuration of the country; (3) the difficulty of holding up water stored in years of good rainfall as a provision against a year of drought; (4) the character of the soil; and (5) the large number of different states and territories into which the country is divided and sub-divided.

The Tanjore District lies between 9° 50′ and 11° 25′ North and 78° 55′ and 79° 55′ East and has an area of roughly 3,700 square miles. The river Coleroon forms the northern boundary separating it from Trichinopoly and South Arcot districts and on the West lie the Native State of Pudukottah and the district of Trichinopoly; on the South is the Madura district and on the East, the Bay of Bengal. It is a coastal district having two sea boards of nearly 150 miles, the one stretching from the mouth of the Coleroon to Point Calimere in the South (72 miles), and the other from Point Calimere to Palk Strait (68 miles). The district can be roughly divided into three major regions:—(1) *The deltaic portion* is about half the total area of the district and is an undulating alluvial plain with a gentle slope down towards the East; (2) *The non-deltaic portion*, which is similarly devoid of hills, slopes down towards the East and South-east and has an average elevation of about 50 feet above the deltaic tracts. In this region towards the South and South-west of Tanjore City lies the Vallam Table-land; and (3) *the vast salt swamp* from Point Calimere to Adirampatnam—which in some places is 30 miles wide and usually under water for a great portion of the year.

The district known as "The Granary of the South" and the waters of the Cauvery have contributed to the enrichment of its soil and the growth of civilisation. Thus a confirmation of the maxim that civilisation follows rivers is found in this case. The Cauvery rises in the Western Ghats near Mercara in Coorg at a height of 4,400 feet above sea-level and falls into the Bay of Bengal draining nearly 31,000 square miles in its course of nearly 500 miles. The river has three important tributaries, the Bhavani, the Noyel and the Amaravati. From the source of the river upto the head of the delta at the Upper Anicut, the Cauvery has a catchment area of 26,172 square miles. Both the South-west and the North-east monsoons influence the catchment area —the former 15,700 square miles and the latter 10,500 square miles. But lower down the Upper Anicut, the whole area is mostly influenced by the North-east monsoon. The Cauvery delta system is a very ancient one and conforms to what is called the "Direct-flow system". The construction of the Mettur Dam


MAP OF RIVER CAUVERY
SHOWING
CATCHMENT AREA, THE METTUR RESERVOIR
AND THE
NEW IRRIGATED AREA.
Scale. Miles.
REFERENCE
District Boundary
Railway Line
New Irrigated Area
Catchment Boundary
BAY OF BENGAL
ARABIAN SEA
BANGALORE
R. CAUVERY
TANJORE
TRICHINOPOLY
MYSORE
SALEM
COIMBATORE
MADURA

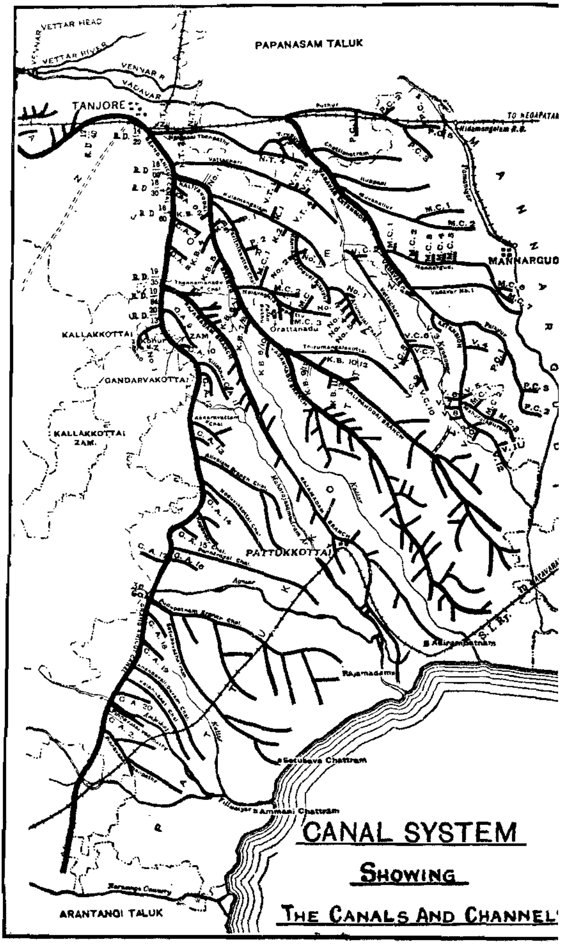
improves it to a "Storage system". The conversion of the Cauvery river system from the inundated to the controlled type has been effected with a view to minimise the dangers to the deltaic tracts during heavy floods and to utilize the surplus waters running to waste in the sea for the benefit of the drier upland tracts of the Tanjore district. Agriculture with the aid of irrigation water, now known by the term "Irriculture", is a very ancient industry in South India. The anicuts constructed by the Indian rulers long long before the advent of the English, had subsequently fallen into disrepair owing to the disturbed political conditions in South India and the consequent neglect of settled agricultural pursuits. When the East India Company took over the Tanjore district in 1801, the irrigation facilities had got considerably reduced due to the silting up of the channels and it was left to the late Sir Arthur Cotton to devise measures for removing the difficulties by the construction of the Upper Anicut across the river, 10 miles West of Trichinopoly, in 1836. The good work started by Sir A. Cotton was continued and the work as it stands at present was completed in 1902. It is near the Upper Anicut that the main stream divides itself into two: the Northern arm is called the Coleroon and the Southern arm retains its original name of Cauvery. The two rivers meet again 20 miles lower down and thus the sacred island of Srirangam is formed. The Grand Anicut—1,080 feet long—is the oldest irrigation work in the Cauvery delta and was originally constructed by the Chola Kings and subsequently improved on modern lines in recent years. The object of the Anicut is to prevent the flow being wasted into the Coleroon which serves as a main drainage. At the Grand Anicut, the Cauvery bifurcates into the Vennar and Cauvery proper, and there are works at the head for regulating the flow. After satisfying the requirements of the delta, the surplus is diverted into the Coleroon which by means of the Lower Anicut irrigates 37 square miles in the tail-end of the Tanjore district and a portion of the South Arcot district. The Lower Anicut is constructed 70 miles below the Grand Anicut and 28 miles from the mouth of the river which enters the sea at Devakotta, South of Porto-Novo. It is stated that even in years when no definite supply had been made through the works, there is an adequate flow in the Coleroon to meet the requirements of cultivators under the Lower Anicut system. Though various reasons are given by way of explanation for this fact, it is suspected that there must be some hidden springs in the Coleroon to give such an unfailing supply. The theories of percolation and surplus waters, etc., though they *may be justifiable are not entirely convincing.*

The ill-distributed rain-fall, the unequal distribution of the number of days of normal flow and the wastage of the surplus water gave the necessary impetus to both the Mysore and the Madras Governments for launching on reservoir schemes. The construction of the Krishnarajasagara Dam by the Mysore Government was followed by the construction of the Mettur Dam by the Madras Government. The experiences of the unprecedented 1924 floods with a discharge of 475,000 cusecs at the Upper Anicut had nècessitated alterations in the original dimensions of the Mettur Dam with a view to meet even such extraordinary contingencies. A distance of nearly 120 miles separates the Dam from the head of the delta.

The objects aimed at by the control system are :—(i) the protection to the irrigation works during floods ; (ii) provision for improved and regular irrigation facilities to the old deltaic tracts ; and (iii) extension of irrigation to the non-deltaic tracts by the utilisation of the surplus water running into the sea.

Canals :—The Grand Anicut Canal the head sluice of which is on the right bank immediately above the right flank of the Vennar Regulator, is intended to irrigate and bring under cultivation 3,01,000 acres of the non-deltaic tract in addition to effecting improvements in deltaic irrigation. The new area is commanded by the Mettur Canal and the Vadavar Extension. The level of the Cauvery at its source as already stated is 4,400 feet above mean sea-level and that of the river bed at the site of the Dam is about 620 feet above mean sea-level. Thus within the course of 250 miles there is a fall of 3,780 feet. The level of the river bed at the Grand Anicut Canal is nearly 196 feet above mean sea-level.

As already indicated, the fall of the land in the non-deltaic portion of Tanjore district is towards the East and South-east. This region is more or less a plain interspersed with spurs and having very gradual fall of 3 to 5 feet in a mile. The Grand Anicut Canal, unlike many of its distributaries, is strictly a contour canal, that is, a canal which avoids short cuts through ridges and embankments and takes a longer course adapting itself to the level of the region and following the contour lines. This fact is borne out by the absence of any but a single off-take from the canal on its right side and by its flow along the ridges and not cutting them. Ellis in his Manual at paragraph 419 lays down certain principles for the lay-out of a distribution system. They are : the economical distribution of water, adequate command and


PAPANASAM TALUK
VETTAR HEAD
VETTAR RIVER
VENVAR R.
VADAVAR
TANJORE
TO NEGAPATAM
KALLAKKOTTAI
GANDARVAKOTTAI
KALLAKKOTTAI ZAM.
Orattanadu
PATTUKKOTTAI
Rajamadam
Setubava Chattram
Ammani Chattram
ARANTANGI TALUK
CANAL SYSTEM
SHOWING
THE CANALS AND CHANNEL

least interference with natural drainage. In certain cases, the principle of not interfering with the natural drainage is to be given up where it is not otherwise possible to command the land. The modification of the principle indicated above is illustrated by the Canal crossing the Mahasamudram and the Agniar rivers. The distributaries under the Grand Anicut Canal system generally go on ridges so that they command the land lying between the tops of the ridges and the bottom of the valleys between. The valleys or the depressions in the land form the natural drainage courses and interference with the same probably accounts for the ineffective drainage of the area after the construction of the Canal.

The Grand Anicut Canal flows southwards as it issues from the head sluice. Further down it crosses the abandoned course of the old Vennar and taking a sharp bend runs almost parallel to the Vennar, the right bank of the Vennar being the left bank of the Canal. The main Canal is 66 miles long from its head to the Narasinga Cauvery zone in the Arantangi taluk. The further extension of the Canal was not possible due to the conditions of the Mysore-Madras agreement in respect of the distribution of the Cauvery waters, and also the poor soil South of the Narasinga Cauvery zone. The two main off-takes from the Canal are the Kalian Odai and the Rajamadam Channel. The Canal with its distributaries has a total length of 760 miles. The bed-width of the Canal is 180 feet, the full supply depth is 7 feet at the head-works; at the tail-end, the bed-width is only 30 feet and the full supply depth is 5·25 feet. The discharge capacity which at the head is 5,000 cusecs, at the tail-end becomes only 300 cusecs. The bed fall is gradually increased from ·15 feet/1000 feet at the head to ·165/1000 feet at the tail-end to keep the velocity as high as possible. It should be noted that there have been two deviations from the originally proposed alignment. The first division is in the Canal entering the Tanjore City and the second is in the omission of the part of the Pudukottah State from the ayacut of the Canal. It was first thought that the cost of acquisition of land within the City limits would be prohibitive but this became inevitable by the later deviation necessitated by the difficulties in arriving at a satisfactory agreement with the Pudukottah State regarding the terms of distribution of water.

The Canal before entering the Tanjore district crosses the Sholagampatti Vari, the largest cross-drainage above Tanjore and also cuts the South Indian Railway. The Canal enters the Tanjore district near Budalur nearly 11 miles East of the Grand Anicut and takes an almost easterly course keeping to the South

of the South Indian Railway line. The cutting at Budalur is nearly two miles long and the maximum depth is 17·5 feet. At *Ramanathapuram*, close West of Tanjore City, it takes a slightly Northern curve to avoid the Vallam plateau which would involve cutting of 44 feet, and cuts for a second time the Railway line. It was in this reach of the Canal system that blasting operations had to be resorted to for cutting through laterite underground, thus entailing the utilisation of manual labour instead of machinery. The Canal then enters the Tanjore City where the maximum cutting is 26 feet. The width of the Canal at this stage where it cuts across the Muhammadan grave-yard, is only 84 feet thus giving a special tapering from 172 to 84 feet in a distance of 440 feet. The depth which even at the headworks is 7 feet had consequently to be increased to 10 feet and the slope of the Canal is also increased to ·205 1000 to augment the velocity of the stream with a view to prevent sand and silt deposits. The normal width and depth of the Canal are restored beyond the City limits by means of a reverse taper. Such an increase in depth and velocity inside populous city limits will be attended by greater drowning accidents and more frequent damages to the Canal bund. The latter difficulty has been partially got over by protecting the side slopes throughout. The third crossing of the Railway line is just East of the Railway station and from there onwards the Canal has a southerly course to the East of which lies the new area to be irrigated. This region lies to the South of the delta reaching nearly the sea in the South, extends in the East, upto the Paminiyar and on the West up to the Pudukottah State border. The Canal—after the two principal off-takes mentioned above—crosses several jungle streams which cut across the irrigated area, the chief of such streams being the Kattar, the Maharajasamudram and the Agniar. These streams and cross-drainages are crossed by super-passages, syphon aqueducts and bridges. The Canal runs in high embankments in certain places. After cutting the Tanjore district board railway to Arantangi, the Canal bifurcates into the *Ammanichattaram* and Tiruvappadi distributary channels.

Vadavar Extension:—Prior to the contruction of the Canal, the river Vadavar was irrigating nearly 15,000 acres in the deltaic and non-deltaic portion of the district. Unlike the Grand Anicut Canal which is purely an irrigation canal, the Vadavar in its course of 21 miles from the Vennar to its fall into the Vaduvur Eri serves both irrigation and drainage purposes. It not only takes the surface run-off of its catchment area but also is useful for diverting the surplus waters of the Cauvery during times of heavy

floods. The surplus from the Eri goes by the name of the Kannanar which empties itself into the Paminiyar. Nearly half the waters of the Vadavar were left unutilised and hence an improvement in the canal system was found necessary for commanding a wider ayacut. The extension to this canal system commences just above this outfall into the Vaduvur Eri and is seven miles in length. This extension is intended to irrigate 28,000 acres.

Temperature and Evaporation :—As in the deltaic areas, May and June are the hottest months in this region too. The temperature records maintained at Negapatam show that the average minimum temperature of the place varies from 70·8° in January to 80·2° in May, and the average maximum from 81·5° in December to 97·3° in May. The average annual maximum and minimum temperatures are 89·8° and 75·9° respectively while the annual mean is 82·9°. These temperature records of averages arrived at on the basis of a coastal town like Negapatam cannot correctly indicate the temperature of places in the interior, especially in the non-deltaic area coming under the Canal system.

The reservoir at Mettur with its storage capacity of 93,500 million cubic feet is said to have considerably reduced the temperature of the adjacent places. This is ascribed to the greater evaporation and greater humidity consequent thereon in the atmosphere. The difference in the temperature in the past between deltaic and non-deltaic portion in the district has been accounted for by the vast tract in the former of irrigated land under paddy crop. If the aim of the project in bringing under paddy nearly 3 lakhs of acres is realised, the Canal with its net-work of distributaries must have considerable influence in moderating the temperature in the region.

The absence of temperature records in typical places in the canal zone and the lack of statistics covering a fairly long period could at best lead to only tentative conclusions.

Rainfall :—The function of irrigation is mainly to supplement the deficiency in rain-fall or to conserve rain water in tanks and lakes where it is unequally distributed. Over-irrigation is as injurious as deficiency of rain. Irrigation may tend to minimise the distress of a partial failure but can never be a substitute for rainfall, especially in respect of crops like paddy which for their successful growth require periodical rain in large quantities, as rain water alone contains a larger proportion of oxygen content and is better suited to stimulate the roots to action. Howard writes :

"The researches of Mr. Harrison and his staff at Coimbatore on the gases of swamp rice soils have drawn particular attention to the importance of the oxygen supply of the roots of the rice crop by means of a slow movement of aerated water through the upper layers of mud in which this crop grows. The roots of rice must have a *constant supply of oxygen.* As they are immersed in mud and water, the only way this substance can be provided is in solution in the water which must move slowly through the soil . . . . . ."

The Indian Irrigation Commission in its Report states the part played by rainfall in determining the necessity for irrigation in the following words:

"The main factors determining the use and value of irrigation in any part of India, whether from a purely productive or from a famine protective point of view, are the rainfall, soil and the classes of crops suited to the soil, climate and other local conditions. Rainfall may be so abundant and assured as to render irrigation superfluous, and *even injurious*; or, though ordinarily sufficient it may be so liable to periodic failure or unseasonable incidents as to call for irrigation as a protection against its uncertainty; or, it may in all years be so scanty as to make cultivation impossible without irrigation. The soil may be so inferior that the increased yield due to irrigation would not repay the cost of providing it: or it may be so retentive of moisture as to render artificial waterings unnecessary except in the driest year".

The average rainfall of the Tanjore district from 1870 to 1929 *is 44·77" as against* an *average of 48·6" in the past 8 years.* There has been an increase of 4" over the average but in 3 out of the 8 years the rain-fall has been less than the above average. Though the district depends on the South-west monsoon for the commencement of its agricultural operations, it is the North-east monsoon that supplies the deficiency in the direct flow due to the exhaustion of the South-west monsoon. The bulk of the local rain for the upland tracts is brought by the North-east monsoon. In the past few years, a noticeable feature in the rainfall of the district is the late break-up of the monsoon and the abundance of rain in unseasonal times. The district for the purpose of rainfall may be roughly divided into the littoral, central and inland regions. The seasonal distribution is as follows:

Section.	January to March.	April to May.	June to September (S.W. monsoon).	October to December (N.E. monsoon).	Total.
Littoral ..	5·38″	3·18″	9·48″	31·79″	49·83″
Central ..	4·58″	3·19″	12·23″	25·98″	45·98″
Inland ..	3·24″	4·00″	11·17″	19·44″	37·85″
District average ..	2·99	2·99	12·27	26·52	44·77

Thus the coastal taluks of the district receive a greater rainfall than the interior. The Western and central taluks of Tanjore and Papanasam get only an average rainfall of 37 and 39 inches respectively. Though in the taluks of Pattukottah and Arantangi, South of Tanjore there is not great deficiency of rain-fall, and the departure from the average is slight, yet they are very dry taluks. The agriculture practised in 9 out of the 11 taluks of the district depended on the Cauvery irrigation for a very long time. The Grand Anicut Canal system has extended the benefit of Cauvery irrigation to the other two taluks also. At present, the high, upland tracts of the Tanjore and Pattukkottah taluks and a major portion of the Arantangi taluk are left out of the benefits of irrigation from the Cauvery.

In the non-deltaic tracts prior to the construction of the Canal, rain water was collected in tanks. Tanjore and Pattukkottah, the two important taluks of this region, have the largest number of tanks, viz., 199 for Tanjore and 195 for Pattukkottah, i.e., 394 tanks out of 445 for the whole district, the ayacuts of which range from 50 to 500 acres. The cultivation of the region was dependent on rain and its failure resulted in famine conditions. In the hottest part of the year the water stored in the tanks was useful for both men and cattle. Now the Canal takes water direct to most of these tanks thus ensuring a well-regulated supply. But some of the tanks are private and the Canal runs through zamindari tracts. There are differences of opinion between the Government and the cultivators regarding the water-rate to be charged and this has necessitated the cutting off of supply to some tanks. This region which had been depending on rain for cultivation had a variable cultivation season but with the construction of the Canal, the cultivation season has tended to approximate to that in the deltaic taluks. With the regulation of water a greater rhythm and symmetry in the cultivation season throughout the district has become possible. The following observations of Colonel Ellis, who was responsible for the project in its initial stages on the effect of

controlled irrigation on agricultural practices are worth quoting here :

> "The existing cultivation customs and season of cultivation (in the district) are those which experience has shown to be more suitable for the raising of wet crops with the existing seasonal distribution of river flow and rain-fall.
>
> The effect of the reservoir on these seasonal supplies will be :
>
> (a) to secure an adequate supply at an earlier average date than before, both for double and single crop lands, and to guarantee that once such supply is issued, it will not, as at present, be subject to fluctuations of a nature which cannot be foreseen : and
>
> (b) to ensure, from the time of transplantation (of paddy), a steady and adequate flow for the irrigated area by impounding excess flow for issue when the natural flow is deficient. The general effect of this alteration on the cultivation practices will be to make transplantation of both double and single crop lands earlier, and this especially applies to the single crop lands in the eastern part of the delta (i.e., the tail-end lands) where transplantation is now delayed on account of the frequent failure in September and October of the flow supply which is generally available in July and August (the South-west monsoon period) thus leaving early transplantation to wither for lack of water before the North-east monsoon rainfall on those lands is available to supplement the free flow supply."

With the development of the area commanded by the Canal, it would be possible to correlate the acreage under cultivation and the output with the amount of rainfall and the irrigation water. The effects of the Canal irrigation on the nature of the soil and the crops grown can be fully ascertained in the light of further experience.

Soil.—Apart from soil survey conducted for purposes of settlement operations, no systematic or scientific survey of the soil seems to have been made prior to the construction of the Canal. As already observed, the deltaic tracts contain rich alluvial loam while the soil of the non-deltaic portion may be described as light brown sandy loam except in the areas lying between the Grand Anicut and Tanjore—the portion north of the Grand Anicut Canal which has red loam and black soil. The alluvial soil of the delta is con-

spicuously absent throughout the region and the red ferruginous type generally predominates. The following table sets forth the percentage of soils for each taluk for wet and dry areas separately. It is interesting to note that regar and alluvial are completely absent in the Pattukottah and Arantangi taluks which come under the Canal irrigation. Here more than 99 per cent of both wet and dry cultivated areas are of the red ferruginous variety and the arenaçeous variety is found mostly in the coastal taluks of Negapatam and Shiyali.

Taluk.	Alluvial.		Regar.		Red Ferruginous.		Arenaceous.	
	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tanjore	32·0	6·0	39·0	10·0	29·0	84·0	..	..
Papanasam	28·6	38·0	68·2	22·4	3·2	39·6	..	..
Kumbakonam	64·0	59·0	36·0	41·0	..	..	..	..
Mayavaram	70·5	60·8	22·8	21·1	..	..	6·7	18·1
Shiyali	..	..	76·2	53·2	..	..	23·8	46·8
Nannilam	54·9	55·7	45·1	43·9	..	..	..	0·4
Negapatam	..	..	92·4	45·1	..	..	7·6	54·9
Mannargudi	..	..	87·3	15·0	12·7	85·0	..	..
Tiruturaipundi	..	..	92·9	61·2	1·1	10·8	6·0	28·0
Pattukottai	..	..	..	..	99·7	99·7	0·3	0·3
Arantangi	..	..	..	..	98·7	86·8	1·3	13·2

The absence of any rocky formation except near Vallam gives a deep soil. Rock soil and laterite are in places interspersed with occasional stretches of black loam, having a quartz substratum. Wells sunk in the area reveal whitish clay beyond a depth of 20 feet but this is absent nearer the surface. This is due to the gradual soil erosion consequent on monsoon rains and uncontrolled run-off. This depletion of the plastic clay makes the soil appear on the surface open, porous and permeable. The necessity for frequent irrigation will be felt in such soil especially when rice is cultivated. One of the imminent problems awaiting investigation and solution is how to render this porous and permeable soil capable of retaining more moisture. This calls for a thorough and scientific survey of the texture and chemical composition of the soil. It is believed that an increase in the humus content of the soil will bring about greater ability to retain moisture.

Canal irrigation and drainage.—In the words of Howard, "Canal irrigation in the hands of the cultivator seems to put a brake on the wheel of life". He is benefited or adversely affected

to the extent of his capacity to use the brake properly. Though irrigation makes up to some extent for poor cultivation, it has to be recognised by the cultivator that cheap and abundant water is a doubtful blessing. Over-irrigation leads to low productivity and constant waterlogging leads to the formation of alkalies and toxins injurious to plant growth. The Royal Commission on Agriculture has the following pertinent remarks on the evils of over-irrigation :

> "Many of the troubles which have arisen in the irrigated tracts of India in regard to waterlogging and the formation of alkali lands have been due to failure properly to correlate a new irrigation system to the natural drainage of the tract. We, therefore, consider that drainage maps should be drawn up by competent engineers who possess the necessary agricultural insight. Once these maps have been made, it will be easy to control all such undertakings as the construction of roads, railways, canals and embankments, and to see that nothing interferes with crop production."

Not satisfied with these recommendations, they have further suggested the advisability of the engineers undergoing a short course in agriculture and agricultural graduates taking lessons in applied engineering. The Madras Government for reasons of its own had ignored this wholesome and salutary advice.

It is with a view to avoid the evils of perennial irrigation that the ancients were satisfied with what is called the basin system which combined both irrigation and drainage. King in the course of a very interesting and elaborate discussion of this problem in his book "Irrigation and Drainage", writes :—

> "It is a noteworthy fact that the excessive development of alkalies in India, ... are the result of irrigation practices modern in their origin and modes, and instituted by people lacking in the traditions of the ancient irrigators who had worked the same land thousands of years before. The alkali lands of to-day, in their intense form, are of modern origin, due to practices which are eminently inadmissible, and which, in all probability were known to be so by the people whom our modern civilisation has supplanted."

The Grand Anicut Canal was never thought to be a drainage work. The jungle streams cutting across functioned effectively as natural drainage channels. No proper arrangements appear to have been made for linking them with the drainage works and thus

to draw off the surplus waters of the irrigation channels and the percolation waters of the area. With the Canal flowing for more than six months in the year and the monsoon rains, the proper drainage of the area has become an acute problem. If it is a ridge canal, the question of cross-drainage work would not arise. But the Grand Anicut Canal being a contour one in its entire length of 66 miles, the difficulty of cross-drainage has been partially got over by syphons, super-passages and syphon aqueducts. The interference with the natural drainage system, the seepages, and stagnant pools formed by borrow-pits have added to the complexity of the drainage problem. Continued water-logging and the existence of stagnant pools have been responsible for the increase of mosquito nuisance and malaria in the region. The records of hospitals in the taluks served by the Canal show an increase in the number of patients treated for malaria and it is apprehended that unless speedy and effective measures are adopted to counteract the spread of the disease, the Canal, while conferring from the economic point of view a doubtful benefit, will prove to be a positive menace to the health and living conditions of the people in the locality.

The difficulties of water-logging in the area would be considerably enhanced if the lay-out of the roads and railways prevent or interfere with the natural drainage. It is a common experience that the Railway Companies in laying out the lines have not paused to consider the adverse effects on the cultivated lands by the embankments serving as barriers against the free flow of water. The proposed Tanjore-Pattukkottah line crosses the Kalian Odai in four places and unless sufficient precaution against water-logging is taken by the Railway, cultivated lands are sure to be affected very adversely. The growth of natural vegetation along the canal routes and the extensive rice cultivation will add considerably to the intricacies of the problem. Dr. Russel of the Rockfeller Foundation while admitting the above facts suggests that air-tight shutters will prevent the percolation of water. The suggestion to fill up the borrow-pits with earth looks rather funny considering the fact that these borrow-pits themselves were formed by excavations for forming and strengthening the embankments. The suggestion does not take into account the difficulty of getting earth from distant places to fill up these pits. Perhaps, the growing of reed might serve the purpose better for while removing the stagnant pools, it might also lead to the development of mat making as a cottage industry.

Crops and vegetation.—Though irrigation is one of the prime needs of agriculture in India, the suitability of the soil, the scientific manuring of crops based upon a careful study of soil composition, proper rotation of crops and the eradication of insect pests are other factors which have a large bearing on the question. There seems to have been no planning in respect of the future development of the area in spite of the emphasis laid by the Royal Commission on Indian Agriculture on the necessity of concerted action on the part of the departments concerned. It is necessary to study the reactions of plant life to canal irrigation. It is only very recently that an agricultural farm was started at Pattukkottah which is engaged in experiments connected with the raising of new money crops like sugar-cane, cotton groundnut, turmeric, plantains and soya beans. The money crops suggested for purposes of cultivation must have relation to the soil on which they are to be grown and the economic resources of the growers.

As already observed the region was depending mostly on the North-east monsoon for its water supply, but since the introduction of canal irrigation, constant and steady supply of water throughout the agricultural season is ensured. Agricultural practices and the nature of the crops grown are governed by the change in the environment. Till now only dry crops were grown in the area and they were mostly rain-fed. The failure of the North-east monsoon brought about untold misery to the cultivators. The vagaries of the monsoon had been, in certain years, so pronounced that it was feared that famine conditions were likely to affect even the fertile district of Tanjore. Paddy, the staple product of cultivation in the district, is an irrigation crop in the deltaic tracts, and a mainly rain-fed one in portions of the dry tracts. The seeds were broadcast and no nurseries were maintained in the dry tracts. The best yielders, under such circumstances, were the coarser varieties of paddy and the dry crops were Varagu, groundnuts, gingelly, ragi and cumbu. Now finer varieties of paddy are first raised in seed-beds and systematically transplanted as in the delta. In the North-western portion where black soil is found coriander is sown. Of the pulses, red-gram is grown chiefly in Tanjore, Pattukkottah and Mayavaram taluks. Pattukkottah grows also a large quantity of condiments and spices. Under fruit trees and vegetables, cocoanut and jack predominate, the former in the Pattukkottah and Tirutturaipundi taluks, and the latter chiefly in Pattukkottah. If the anticipated conversion of dry lands into wet is fully realised, there will be a shrinkage in the area available for the cultivation of dry crops. Such a conversion is bound to have reaction

not only on the quantity and quality of the produce raised but also on the methods of cultivation adopted. Groundnut is likely to be benefited by canal irrigation making good the deficiencies of rainfall. It may, therefore, be anticipated that both an increase in the yield per acre and an extension of the area cultivated under groundnut will be possible. It is the chief money crop of the district but due to the fall in price the acreage under cultivation in the last decennium is only 67,638 as against 78,985. But the cultivators are to be warned against the dangers of over-irrigation. Over-irrigation and constant water-logging prevent free soil aeration and the assimilation of oxygen by plants and the fixation of atmospheric nitrogen in the soil. Further, the mineral salts so essential for plant growth are entirely washed away and at times they are found in a concentrated form in low lying areas. Plaginol and Storer concluded, as a result of experiments conducted by them, that soils having more than 2% salt are rendered unfit for cultivation. King's remarks on the formation of salt crusts made long ago are still true. He remarks :

> "If irrigation is practised during the growing season only, and if this water also is evaporated from the soil in addition to the natural rainfall, it is plain that the content of soluble salts in the soil must increase, both on account of that which may have been in the water applied, and that which this additional water may have been instrumental in producing from the soil on the spot through the processes of weathering. Indeed, the more we study and reflect upon this problem, the more we are led to fear that in all arid climates, where irrigation is practised, it will not be found sufficient to apply simply enough water to the soil to meet the needs of the crop growing upon the ground at the time, but, on the contrary, there must be enough more water applied to take up and carry away into drainage channels and out of the country to the sea not only the soluble salts which the irrigation waters carry, but also those which it causes to be produced from the soil and the sub-soil."

The jack tree which till recently flourished in Pattukkottah taluk and noted for its high quality of fruits is becoming extinct. It is a popular belief that jack thrives best under dry conditions and that the canal water has been responsible for the extermination of the tree which has been a source of subsidiary income to the cultivator. In Malabar, the jack thrives in spite of the heavy monsoon rains but regarding flavour and taste, the Malabar jack

fruit cannot compare favourably with the Pattukkottah variety. Attempts must be made either to preserve the indigenous variety or to introduce another suited to the changed conditions.

Casuarina is another tree which has now been adversely affected by the Canal. In the drier tracts, especially in sandy regions, the tree was grown on soils not suitable for any other remunerative crops. The water requirements of the casuarina are strictly limited to the first few months till the seedlings get fixed in the soil. The percolation of water from the Canal and its distributaries is stated to have arrested the development of the tree to its normal size.

The drier tracts of the Tanjore district were noted for their vegetable and garden produce which were mostly grown for city markets near at hand. Though under canal irrigation the quantity of vegetable produced is increasing yet there has been a considerable falling off in the quality of vegetables. A comprehensive study seems to be necessary before large areas are brought under cultivation of any particular crop.

The fluctuations in the level of the water-table due to Canal irrigation and the response and reaction on the roots of old and new vegetation must be enquired into before formulating any policy affecting the agricultural development of the area in question. It is stated that the water-table in this region has risen to a level of 5 to 6 feet from roots of the plant while in the deltaic Papanasam taluk which has been under irrigation from time immemorial it is 20 feet below. It is interesting to note in this connection that there has been recently a variation in the level of the water-table in the Punjab Canal region and the Government have appointed a Committee for investigating its causes and for suggesting remedies. It is hoped that the findings of the Committee will throw further light on the variations in the level of the water-table, information on which subject has so far been scanty and at best vague.

The Central Board of Irrigation, at its recent deliberations at New Delhi, considered the economic aspect of lining canals with a view to prevent water-logging and to conserve the water let in for irrigation. In the absence of reliable data regarding the loss by seepage, the Board was reluctant to commit itself to any definite conclusion and has deferred the further consideration of the question to a later date. But the Board has been definite from experiments in lining of canals conducted in the Haveli Main Canal that leakage could be prevented by lining canals with reinforced brick

tile cement "sandwich". At the same time it has been pointed out that the canal lining is liable to be blown up when the canal is emptied, due to pressure from subsoil water, especially where the canal runs through an area with a high water-table.

Considering the cost and also the fact that in the area under consideration the water-table is within six feet, and water will be flowing in the canal only during six to seven months in the year, it would be inadvisable to resort to this method of lining the canals with a view to avoid seepage.

In some canal areas in North India (chiefly in United Provinces and the Punjab) staunching of canal beds and canal sides and the prevention thereby of seepage has been tried by substituting the impervious sodium clay for the porous earth, since sodium-clay has the merit of possessing "self-healing" properties even where punctures are caused in such clay soil. This method of lining and staunching would seem to afford a cheaper alternative and how far this can be tried with advantage in the Grand Anicut Canal area is to be seen.

As has already been pointed out, irrigation by itself cannot bring about prosperity to the agriculturists. The necessity for the improvement of the soil by increasing its humus content is great. In the absence of forests, improvements in this direction cannot be effected. Indigo, sun-hemp and other varieties of green leaf manure may be sown and cultivated. Even here cattle nuisance has to be contended with. Chemical manures are costly and it is believed that they have only a transitory effect in improving the crops on the land without bringing about the desired improvement in the soil itself. Oil cakes and fish guano are other manures usually thought of but the difficulty of crushing and exporting the oil and the non-availability of fish guano in sufficiently large quantities militate against the use of these manures. So, the agriculturist is thrown on his slender resources of farm-yard manure on which also a heavy strain is imposed by way of domestic fuel. The insufficiency of manure and the poverty of the soil had been hitherto made up in the canal region by the periodic migration of herds of cattle and sheep from the border district of Ramnad. These herds were in great demand for hire just before the commencement of the cultivation season. Hence the cost of manuring by this method becomes prohibitive for the average agriculturist. This intense demand just before the cultivation season is due to the fact that long exposure to sun and rain tends to reduce the efficacy of the droppings of the cattle as manure. The poor soil and the

extension in the area of rice cultivation are likely to increase the cost of cultivation. *Moreover, the continued fall in the price of* agricultural commodities especially of paddy is another factor which tends to discourage further extension of wet cultivation. But Mr. Howard in his book " Crop production in India ", makes the following statement regarding extension of rice cultivation with increased irrigation facilities.

> " In the deltaic tracts of the peninsula, the extension of irrigation facilities has always developed the cultivation of rice rather than the production of sugar. So far, the scientific basis of this marked preference for paddy has not been investigated. It is probable that the ryots' preference for rice *has a real scientific basis.* Paddy lands are self-sufficient as far as nitrogen is concerned. Sugar-cane needs expensive nitrogenous manure ".

Though this statement may be true of the deltaic tracts, it is not true of the canal region. Sir Arthur Campbell in inaugurating the works pointed out the potentialities of the new area and refuted the theory of over-production of rice in the Tanjore district due to canal irrigation. His contention is based on the fact that the *population of the presidency in a period of 50 years has increased* by 51% while the crops with and without irrigation have increased only by 43% and 29% respectively. Further, taking the 1928 to 1933 figures, he proves that the area under sugar-cane has increased by 36%, plantain by 14% and paddy only by 4½%. But this line of reasoning is fallacious in that rice is grown very extensively and sugar-cane and plantains are money crops which tend to extend under irrigation facilities. The fact that the abandoned tank beds even when offered under most favourable terms are not demanded and that there is lack of response in utilising the canal water for purposes of wet cultivation go to prove that under the present level of prices, the agriculturist is reluctant to grow any new crop. The area actually irrigated by the canal at the end of the 4th *season is only 96,000 as against a forecast of 1,04,300 acres.* The following figures relating to the acreage brought under cultivation after the Canal has been opened for irrigation speak for themselves :

	1933–1934.	1934–1935.
Vadavar ..	13,889	22,134
Grand Anicut Canal ..	22,845	62,314
	36,734	84,448

The forecast that the new area would be fully developed in 1943-44 is bound to fail considering the pace of development due to economic depression. The expectations of the authors of the Grand Anicut Canal system may not be realised even in the distant future due to the low agricultural prices, the cost of converting dry lands into wet, the heavy manuring which wet crops require, the low economic resources of the cultivators and the speculative factor in respect of the yield.

Cattle.—The cattle of the district are considered comparatively poor. Occasionally cattle are imported from Salem and other districts. Draught animals are purchased and exchanged at the annual fair held in Neerathanallur where cattle are brought for sale and exchange from great distances. The location of this market for cattle is interesting in that it is situated between two rivers—the Cauvery and the Coleroon—and is also within easy reach of the border district of Trichinopoly. Cattle are kept there for nearly 3 months in the year and the arrangements for the fair are in the hands of the local boards. In the forests of Vedaranyam, a wild species of draught animal is caught and domesticated. They are of a short stature and lightly built, and therefore considered more suited for drawing carts than for ploughing. The cattle epidemic, except for occasional outbreaks, is not prevalent in the district. Before the canal construction, the cattle in the upland tracts suffered from want of water even for drinking. This led to rinderpest. The high percentage of cultivated area to the arable area due to the popularity of rice cultivation, the absence of sufficient grazing grounds and the failure on the part of the cattle owners to raise fodder crops, the promiscuous breeding and common grazing are factors that have contributed to the poor variety of cattle. (In 1931-32 the acreage under fodder crops was 659 acres only, i.e., ·0004 per cent of the total area sown. In 1936-37 this has dwindled to 29 acres, i.e., ·00002 per cent). The low acreage of work turned out per pair of tilling cattle is due to the heaviness of the soil especially in wet cultivation. Another interesting feature in respect of the cattle figures for this district is the disproportionately large number of animals kept compared with the grazing and fodder available. The cattle are mostly ill-nourished and under-fed and there being no proper or adequate provision for stalling them, the cattle suffer in winter when there is standing crop on the land. Very often the cattle are housed along with men in residential quarters. The main food of the cattle is the paddy straw.

Since irrigation facilities are provided during 7 months of the year, it may be possible to increase the fodder supply in the canal area. Suitable crops to serve the purpose of rotation and also of cattle food may be tried in certain localities. The Government has recently prohibited the assignment of porambokes and waste lands in this area. Evidently, the Government wants to take advantage of the increased price that the lands are likely to fetch when the region is fully developed. But before adopting such a short-sighted policy, it would be advisable for the Government to encourage *a controlled system of common grazing ground in and near the* villages. It is unwise to depend on the vagaries of Nature but deliberate, systematic and planned attempts should be made to grow grass as is being done in military grass farms. From experiments conducted on a large scale in Hoshiarpur (Punjab), it was seen that grass farms were self-supporting and a ready market always existed for grass. Moreover cutting grass for cattle instead of allowing the cattle themselves to graze on the grass farm resulted in better yield of grass. It is within the experience of the villagers that if bulls and cows are allowed to graze first and then *goats and sheep, it is more economical and at the same time a larger* head of cattle can be fed thereby with less loss of material.

Intimately connected with the cattle problem is the question of controlled grazing or stall-feeding. The Indian peasant is neither efficient nor rich enough to resort to stall-feeding as the peasant in Denmark. Thus livestock management is an intricate problem *with the Indian.*

With a view to stimulate the growth of fodder and manure crops, the Government would be well-advised to adopt a differential rate of assessment starting in the initial years with a nominal kist, and exempting areas sown with such crops from water cess altogether.

The Tirutturaipundi taluk with its 13,354 acres of waste lands easily occupies the first rank in respect of cultivable wastes available. Next comes the Tanjore taluk with 9,382 acres. The taluks of Mannargudi, Pattukkottah and Arantangi are next in order. Ignoring nearly the 3,000 acres which have neither irrigation nor proper drainage facilities, the rest of the waste lands in the above taluks can be considered as potential sources to which Tanjore and neighbouring districts can easily look up for the supply of cattle food.

Fishery.—It is stated by the Director of Fisheries that the Mettur Reservoir holds out immense possibilities for developing pisciculture. In the course of his report, he instances the case of Mr. H. S. Thomas who got about 100 lbs. of fish per acre in a shallow artificial tank at Vallam without in any way impairing the productivity of the tank. According to this estimate, the reservoir is likely to bring in a revenue of 2½ crores per year from fish alone. But a modest estimate of 5½ lakhs per year is made by the Director himself. In addition to this, the Canal region will provide a subsidiary source of income to the fisher-folk in the area. The fish generally, it is stated, has a tendency to travel upstream. As the Canal is not at all connected with the sea, the possibilities of sea fish travelling upstream are very meagre. Further sea fish do not find fresh water conditions, especially when the supply is not perennial, suitable for their healthy breeding. Some of the tanks in the area are directly linked up with the canal system. The village tanks may be tried as breeding grounds for suitable varieties of fish and experiments in this direction have far-reaching possibilities of success. Hitherto, no systematic attempt has been made to rear fish in village tanks. It was left to the off-chance of fish coming along with the freshes of the year.

In the Canal region, the right to catch the fish seems to have been auctioned to the highest bidder in the past 3 years. It is understood that the Government has recently stopped altogether the system of leasing fishing rights. The damages caused to the Canal and tank bunds by the fishermen in the course of their operation are stated to be very heavy thus necessitating annual repairs to the bunds and beds. This seems to be a flimsy reason for giving up altogether a revenue and deprive the fisher-folk of an income.

Population.—According to the 1931 census, the population of the district was 23,85,920—an increase of 2·4% over the 1921 figures. The population of the Presidency during the same period increased by 10·4%. In point of density of population, the district occupies a second place among mufassal districts, the first being East Godavari. Except in Arantangi, Pattukkottah and Tirutturaipundi taluks, the population is very dense having its highest density in Kumbakonam taluk—(55 for every 20 acres cultivated) and the lowest in the Tirutturaipundi taluk (28 for every 20 acres cultivated). It is worthy to note that the greatest density of population in the drier tracts is 400 per square mile while the minimum for the delta is 700 per square mile. It is estimated that if the new area of 625 square miles is fully developed it will attract 200,000 in-

habitants. The present low density of population both in respect of superficial area and cultivated area is due to the infertility of the soil and its inability to support a larger head of population per acre. In spite of its sparse population the dry tracts of the district have been contributing whenever monsoons failed, a large number of emigrants to the Federated Malay States and Ceylon. J. C Molony, in his Census report for 1911, laid stress on the tendency of population to concentrate in rice cultivating areas. The reason for this is that rice cultivation offers not only better and greater opportunities for employment but has also ability to maintain a larger head of population. Although dry crops demand an intenser labour through out the season, the number of labourers required is generally small as compared with wet crops which engage a larger number of labourers, though spasmodically, at certain definite periods of cultivation, such as transplantation and harvesting. This peculiarity of wet cultivation in respect of labour requirements renders possible the periodic migration of labourers from dry to wet areas. From 1930 onwards there has been a greater concentration of population in the Canal area due to the influx of labourers mostly from the Odda community of Salem for work in connection with excavations of the Canal and its distributaries. The slump in rubber also led to the repatriation of a large number of emigrants from the Federated Malay States and arrested the outflow of labour. The figures of returned emigrants from Malaya and also of assisted emigrants from the Negapatam Port are instructive in that the exodus is great in seasons of drought and less under fairly prosperous conditions.

With an extension in the acreage of wet cultivation, there is scope, for employment at least during a part of the year, for the bulk of the labourers in the Canal area. But due to the slow progress in this direction, the periodic migration of agricultural labourers from this area has not entirely stopped.

Communications.—In spite of the fact that the Cauvery with its net work of distributaries including the Grand Anicut Canal system covers almost the entire district, yet none of them having been designed for navigation purposes can be used as means of communication.

The important towns and centres of the district are connected either by roads or railways. No other district in the Presidency is so traversed by a net work of railways and inter-connected by roads as Tanjore. The local boards maintain 2,331 miles of roads of which 540 miles are metalled. In point of communications the

rich deltaic tract has been more developed than the non-deltaic area. The Mettur Canal area cannot boast of many good roads. The porosity of the soil, the loose sub-soil in many places, the absence of road paving materials and the lack of a steady supply of commercial crops for transport have prevented the formation of good roads. The single line of railway takes a tortuous course connecting the important taluk centres. In the absence of well-developed commercial centres, this is but natural. It is doubtful whether the present communication facilities will be sufficient to meet the demands of a developing area as the one in question. It is understood that the railway authorities are considering the feasibility of connecting Pattukkottai, the hub of the Canal system, with Tanjore town, forming as it were a Chord line. If the proposal materialises, quicker and cheaper transport would be available to the agriculturists and merchants in the area. As, however, the proposed railway route is almost parallel to and in close proximity with the main road between Pattukkottai and Tanjore, it is a matter for consideration how far the competition from lorry and bus transport would affect the earnings of the railway. At present, country carts are taking up transport of produce to the railway stations near at hand. The laying-out of the new line and the development of roads are likely to decrease the importance of existing methods of transport. The Government of Madras has sanctioned one lakh of rupees for laying out new roads and developing the existing roads by removing dead ends in places where the roads have fallen into disuse. Among the important roads under construction in the new area are the following:—(1) Orathanad to Vaduvur; (2) Orathanad to Tirumayyam; (3) Orathanad to Mannargudi; and (4) Papanad to Madukur. There is the possibility of Orathanad which was comparatively insignificant till now of developing into a nodal centre for the Canal area.

Considering the large quantity of Tanjore rice exported to Ceylon annually, it will be worth investigating whether a shorter and cheaper water-route from Point Calimere to Jaffna cannot be thought of for the expeditious transport of rice. The Vedaranyam Canal which skirts the eastern coast of Tanjore and is about 30 miles long is navigable by flat-bottomed boats and is utilised at present for removing salt from the Vedaranyam swamp to Negapatam and other places. With the development of the Canal area and of Point Calimere as a port, the circuitous land route taken by Tanjore paddy to its market can be avoided.

The principle underlying the development of communication is that there should be least interference with drainage or agriculture. In this connection Howard makes the following observation :—

> " While communications in the shape of railways and roads are essential in the modern state, nevertheless their construction must conform to the natural drainage of the country and there must be no interference with agriculture ".

Some recent changes in the irrigation method :—The Mettur Canal has brought about a change in the prevailing practice regarding the supply of water to fields. Hitherto the responsibility for the maintenance of field channels was solely that of the ryots. The land over which a field channel passes belongs generally to the owner of the field. This system led to two difficulties, *namely*, the course of the channel was determined by the requirements of the most influential land-lord in the area and not by the level of the country, and there were frequent obliterations of and interferences with the channels. A reference to successive Settlement Reports supports the conclusion that original beds of channels have been appropriated and converted into fields, leading to the great inconvenience of the owners of fields lower down. The Government, therefore, had to subsequently acquire lands and dig channels afresh in the interests of the land-lords further down. In the Canal area, however, with a view to bring about rapid development, the Government have adopted a different policy. Suitable levels for field channels are taken and the water is taken not to the limit of each field but is made available for irrigating in blocks of not more than 25 acres. The ryots are expected to put up the necessary earth-work for the formation of field channels and bhothies at their own expense. Permits are issued for taking water from the 25-acre-block limit down the field channels. The Government, it is understood, has extended the application of the permit system for a period of 5 years to the cultivators under the Lower Anicut Canal also.

The Government regulated the flow during the several months of the year as dictated by the requirements of the cultivators under the various irrigation works by G.O. No. 2671/1, dated 6th December 1933 and this has been later amended by G.O. No. 402, P.W. (Irrigation), dated 27th February 1937, in the light of difficulties experienced in the first few years of canal irrigation. Elaborate rules are also framed to regulate the supply in times of

floods and droughts. The following tables give the normal requirements in the respective months of the year by the Cauvery, Vennar, Grand Anicut Canal and the Lower Anicut:—

Period.	Cauvery.	Vennar.	G. A. Canal.	Total.
	Cusecs.	Cusecs.	Cusecs.	Cusecs.
June second half ..	5,900	4,600	1,800	12,300
July 1st to 5th ..	7,147	6,353	1,800	15,300
July 6th to 15th ..	7,147	6,353	3,686	17,186
July second half ..	10,677	9,323	3,686	23,686
August first half .	10,620	9,380	3,686	23,686
August second half ..	10,658	9,342	3,466	23,466
September first half ..	8,793	7,707	3,466	19,966
September second half ..	7,149	6,351	2,600	16,100
October first half .	12,500		2,090	14,590
From October 16th to January 31st.	*(Supply required will depend on the state of the north-east monsoon rainfall.)*			

Normal requirements at the Lower Anicut.

	L.C.A.		S.A.
16th to 30th June ..	290		
1st to 15th July ..	1,256		
16th to 31st July ..	1,800	+	100
1st to 31st Aug. ..	2,162	+	300
1st to 15th Sept. ..	1,800	+	200
16th to 30th Sept. ..	1,544	+	200

(After the 15th of October, supply required will depend on the north-east monsoon.)

Effect on deltaic tracts.—The Mettur reservoir with its net capacity of 93,500 million cubic feet is intended to protect the already irrigated area both from floods and droughts and also to afford irrigation to new lands without at the same time impairing the efficiency of irrigation of the older delta. This view is supported by the figures relating to the discharge of water at the Upper Anicut. It is said that the surplus water which goes to waste is alone utilised and that only 16 per cent of the flow is diverted into the Grand Anicut Canal. But the cultivators in the deltaic tracts complain of the shrinkage in the volume of water supplied to them and the present system of irrigation interferes with their normal agricultural operations. During the natural flood season under the direct flow system, agricultural operations commence almost simultaneously both at the head and tail of the

delta area. Thus with the first freshes in the river there is bound to be an all-round and sympathetic activity throughout the entire villages. There is, however, much truth in the complaint that the control system makes the tail-end cultivator wait indefinitely long for commencing agricultural operations or in some years deprives him of irrigation facilities altogether. So there is considerable uncertainty regarding the method of cultivation to be adopted and the crops to be raised. These difficulties are due to the considerable loss in transmission of water since the soil is parched up at this time and the tanks are also flushed. Evidently the regulated system is based on calculation of " duty " but in practical agriculture the requirements of the soil and the nature of the crops grown and other complex matters tend to create a variation between actual requirements and the " duty " arrived at. The errors in calculation in the " duty " have also been responsible for the failure of the control system to meet the requirements of agriculture especially in critical times. Dewan Bahadur R. Narasimha Ayyangar, a former Chief Engineer to the Government of Madras, in his Curzon lectures points out how mistakes on the part of the engineers have made the position of the agriculturists in the delta in certain years precarious. He refers to the reduction in the number of the vents in the Low Level Supply Sluice in the Mettur Dam which was made on the presumption that the occasion for the use of the greater number of vents originally provided for may not arise at all and dependence on the working tables prepared by the officers of the department led to serious consequences in 1935. To quote his words, " we actually found however....that the low level sluices could not meet the demand.....at a critical period during the transplantation season, even though they (all the vents) were fully open ". Added to this, the popular misconception that the greater the irrigation the greater the produce has to be removed if the " duty " is to approximate to the actual needs. The difficulty of the tail-end cultivators is more pronounced in the case of double crop areas under paddy. Hence in a year where there is a shortage in the supply of water due to failure of monsoon, they meet the needs of the situation by resorting to Udu cultivation. This system is not so advantageous as the double crop in respect of yield, yet in periods of drought this is the only crop that could be thought of. This method of cultivation, however, requires heavier outlay for periodic and effective manuring. The tail-end taluks are affected by floods in seasons of heavy rain and starved for water during drought. They are perforce driven to the necessity of raising such varieties of paddy as are conditioned by the seasonal

variations. In this respect, the cultivation of paddy in some of the villages of Shiyali taluk adjacent to the sea is interesting to note. These villages are subject to tidal action from October to December and the yield in the first (Samba) crop is low. After December the lands are flushed out with fresh water from Cauvery channels and a special variety of Kar crop known as *Kullakar* is raised and this crop is irrigated with the help of water from the South Rajan Channel of the Coleroon.

Another complaint of the delta cultivator is that the freshes in the rivers are no longer charged with alluvium as in pre-reservoir years, that the construction of the Krishnarajasagar in Mysore (more familarly known as the Kannambadi Dam) and later the Mettur Dam have considerably reduced the alluvium content. For the Government it is contended that the construction of the Dam has no direct bearing on the reduction of alluvium since the sediment is contributed mostly by the Amaravati and Bhavani which join the Cauvery lower down. The sediment contents of the waters of the Cauvery and of its tributaries have been tested and the conclusions arrived at form the basis of the official version. On the other hand, the fact that it is estimated by the Government that the effective storage capacity of the Mettur Reservoir will be reduced in a period of 50 years by about 10 feet in height due to accumulation of silt, etc., at the bottom, would seem to suggest that the contention of the delta cultivator is at least partially correct. In view of the conflicting and contradictory theories regarding silt-deposition by rivers, the dry and wet silt theories and the differences in the figures arrived at by engineers in charge of the Cauvery and the Bhavani, it is rather difficult to hazard an opinion on the subject. It has, however, to be admitted that there is such a marked difference between the clear waters in the rivers in the post-reservoir period as compared with the muddy-looking water surcharged with sediment in the pre-reservoir years which the Tanjore ryot may be taken to have bargained for. This leads one to the conclusion, in spite of the averments of the departmental officials to the contrary, that the sediment content is now on the decrease. The Government of Madras has under consideration another Project known as the "Lower Bhavani Project" by which it is proposed to divert the waters of the Bhavani for irrigating mostly the dry crop area of Coimbatore district. If that scheme materialises, as it is likely within the next few years, there is a certainty of further reduction in the silt carried by the Cauvery to the Tanjore district.

The ultimate effect of such a state of things will be the gradual deterioration of the soil of the Cauvery delta which is growing rice from times immemorial without the necessity for manuring.

A greater volume of water was passing through the Coleroon and sand also in large quantities was carried down the river to the sea. But with the limitation and regulation of water in the Coleroon, and the diversion of water into the new region, larger quantities of sand are now brought down the Cauvery or deposited by its distributaries in the lower reaches of Tanjore. This phenomenon was noticed several decades ago even before the Mettur Reservoir was constructed and has been given as a reason for the greater and more frequent flooding of the deltaic region. It is believed that the neglect of what are called "Manal-pokees" (sand vents) a characteristic feature of the older irrigation system is the cause of the gradual and noticeable rise in the bed level of the rivers in the Tanjore District. It is doubtful whether this aspect of the question has received that amount of careful consideration and examination which it deserves at the hands of experts.

The delta itself being only the result of gradual deposits and accumulations by rivers, the danger of the rivers overflowing their banks and in places submerging the delta is very great. A more than usual flood will result in considerable loss to life and destruction to property.

Conclusion.—From this survey and from experience of Canal irrigation elsewhere, it is not possible to definitely assert that the Canal irrigation under all circumstances is an unmixed blessing. The beneficial effects on the productive and protective character of irrigation projects are dependent upon numerous factors. Unless a comprehensive investigation over a large span of years on the possibility of developing new areas or giving adequate protection to arid regions is made, irrigation projects are likely to prove more a success from the engineering point of view than from the practical and economic aspect. In almost all the new canal regions in India, the formation of alkalies in soils and the outbreak of Malaria subsequent to the active functioning of the canal as such have become common features. A rage for new irrigation projects has been the characteristic of the years following the recommendations of the Indian Irrigation Commission appointed by Lord Curzon. "Every engineer worthy of the name, in service in the P.W.D., had a scheme ready which he put forward for the consideration of Government and some had a very large number of such schemes". But the one fundamental and salutary principle under-

lying the recommendation was lost sight of by many of them. " Storage is so costly even in the most favourable circumstances that very few irrigation works that depend on it are remunerative ", was the caution of the Irrigation Commission itself. The Linlithgow Commission on Agriculture in India with the weighty recommendation before them of the Irrigation Commission, suggested the utilisation of sub-soil and spring water. Presumably with the completion of the Lower and Upper Bhavani Projects, the optimum point of utilisation of the Cauvery waters would be reached and any further extension of irrigation project would ultimately prove a costly failure, the crushing burden of which will have to be borne by posterity. Evidently this aspect of the question has led the Government to reject the more ambitious Kattalai Canal Scheme designed to irrigate about 50 per cent more of the cultivable and irrigable area than that under the Grand Anicut Canal. Recently the land-holders under the Amaravati river are agitating for the further utilisation of the waters of the river in their own area by the construction of irrigation works. Hence, further extensions of irriculture will be possible only by educating the cultivator to adopt more economic methods of irrigation and by reducing the loss in transmission to the minimum and by facilitating the gravitational flow of water in the channels.

EXPLANATION OF TERMS.

Ayacut.—The area commanded by an irrigation source.

Duty.—The number of acres that could be irrigated for a given quantity of water. (1. cusec.).

Cusec.—Multiplied by $60 \times 60 \times 24$ gives the c. feet of water passing through a spot in a day.

Critical velocity.—The rate of flow of water at which the sediments and other matter are not deposited. The nature of the soil, the velocity of the flow and the weight of the suspended matter are factors that have to be taken into consideration in arriving at the critical velocity.

THE AGRICULTURAL CALENDAR OF THE TANJORE DISTRICT.

Month.	Normal weather.	Agricultural Operations. Delta.	Agricultural Operations. Non-Delta.	Effect of abnormal weather on crops.	Proportion sown or harvested to the total Dt. figures.	Remarks.
January.	**Light showers—cold and dewy nights—North-east monsoon exhausted**	Harvesting of Samba & Ottadan—Groundnut. Sowing: Gingelly. Kullakar in Shiyali.	Harvesting: Samba and Ottadan and Groundnut. Sowing: Gingelly.	Heavy showers affect Samba harvest—Light showers favourable to Cholam and Gingelly. Absence of rain facilitates paddy harvest.	Harvesting: More than half of monsoon groundnut and 1/6 of Samba. Sowing: Gingelly—7/12	No sowing in Arantangi — **Harvesting:** Kar, Ragi & Groundnut.
Feb.	**Dew continues. No rains. Fairly hot days and cold nights.**	Harvesting: Samba, Ottadan and Red-gram. No sowing except of Kullakar in Shiyali.	Harvesting: Samba and Red-gram. Sowing: Gingelly and Kuruvai in Arantangi.	Moderate or heavy rain injurious to paddy harvest—staple crop of the district.	Harvesting: Red-gram—7/10 Samba—3/5 Sowing: Gingelly—1/60	Harvesting of Poombalai in **Pattukkottai.**
March.	**Days are getting hot—Dew disappearing.**	Harvesting: Samba & Red-gram. Sowing: Kullakar.	Harvesting: Samba and Poombalai. Sowing: Kuruvai in Arantangi.	Rain injurious to paddy harvest which is concluding.	Harvesting: Samba—1/6 Red-gram—1/9	
April.	**Hot season begins—Nights are not bad.**	Harvesting: Gingelly Sowing: Summer groundnut.	Harvesting: Kuruvai and Poombalai—Gingelly. Sowing: Summer Groundnut and Ragi.	Rain makes soil lose fertility—Gathering of straw adversely affected. Benefits summer groundnut, garden crops, etc.	Sowing: Ragi—1/60 Summer groundnut — 1/7 Harvesting: Gingelly—7/20	
May.	**Hot month—Westerly winds during latter half indicates break of S. W. monsoon.**	Harvesting: Gingelly and Kullakar.	Harvesting: Kuruvai.	Excessive rain prevents soil aeration and prevention of absorption of nitrogen from the atmosphere.	Harvesting: Gingelly—1/2	**No sowing. Dry cultivation will be postponed if no rain falls.**

June.	Hottest month—High winds—S. W. monsoon commences by the 15th. Rivers and Channels opened.	Harvesting: Kullakar. Generally no agricultural operations. After the 15th Kuruvai seedlings in dry lands.		Rain favours ploughing of wet and dry lands—Filling tanks in the non-deltaic area—raising Kuruvai seedlings in the Cauvery delta.	Harvesting. Kullakar very small.	Practically no agricultural operations.
July.	S. W. monsoon progresses.	Harvesting: Summer Groundnut. Sowing: Samba seedlings—Transplantation Kuruvai *seedlings*.	Harvesting: Summer Groundnut. Sowing: Kuruvai, Samba and Ottadan.	Excessive rainfall prejudicial both to Kuruvai crop and Samba seedlings. Moderate rain beneficial to them and to the cultivation *of dry crops*.	Harvesting: Summer groundnut — 1/7	
August.	Continuance of the S. W. monsoon.	Sowing: Kuruvai, Samba and Ottadan and dry crops.	Sowing: Ragi, Kambu, Red-gram, Groundnut, Gingelly. Samba and Poombalai in Pattukkottai.	Heavy and continuous rain affects Samba nurseries and the dry crops sown. Absence of rain affects Kuruvai—tanks are dry.	Sowing: Samba—1/8 Cumbu—3/4 Ragi—3/10 Red-gram—5/6 Monsoon groundnut — 5/8 *Gingelly*—1/5	Ragi **harvested in** Arantangi.
Sep.	S. W. monsoon gives moderate rains.	Harvesting: Kuruvai. Sowing: Cambu and dry crops.	Sowing: Kuruvai. Ottadan, Samba, Red-gram and other dry crops.	Ripe Kuruvai crop affected by continuous rain — Moderate rain beneficial but absence of rain adversely affects stand*ing crops*.	Sowing: Samba—1/3 Cumbu—1/4 Ragi—2/3 *Red-gram*—1/6 Monsoon groundnut — 2/7 Gingelly — 1/30	Kuruvai **harvest in** *Tanjore* and **Mannar**gudi.

THE AGRICULTURAL CALENDAR OF THE TANJORE DISTRICT *(Contd.)*

Month.	Normal weather.	Agricultural Operations. Delta.	Agricultural Operations. Non-Delta.	Effect of abnormal weather on crops.	Proportion sown or harvested to the total Dt. figures.	Remarks.
Oct.	The setting in of the N. E. monsoon in the middle of the month.	Harvesting: Kuruvai and Cumbu. *Sowing*: Samba.	Harvesting: Kuruvai and Cumbu. Sowing: Samba, Ragi and Poombalai.	Absence of rain facilitates Kuruvai harvesting — Moderate rain beneficial to standing paddy crop.	Harvesting: Cumbu—$3/4$ Kuruvai—$1/30$ Sowing: Samba—$1/4$ Ragi—$1/30$	
Nov.	N. E. monsoon active —Damp weather—at times cyclonic.	Harvesting: Cumbu, Ragi, Kuruvai. Sowing: Samba.	Harvesting: Ragi, Cumbu, Gingelly. Sowing: Samba.	Absence of rain causes a disease 'Soorai' —moderate rain beneficial — Heavy rains submerge tail-end lands and affect standing crops.	Harvesting: Cumbu—$1/4$ Ragi—$9/10$ Gingelly—$1/120$ Samba—$1/12$	
Dec.	N. E. monsoon continues — Cold weather sets in—Nights dewy.	Harvesting: Groundnut. Sowing: Gingelly.	Harvesting: Kar, Groundnut, Ragi, Gingelly. Sowing: Samba (Arantangi).	Heavy rains affect standing crops and harvest of ripe crops —Moderate rain beneficial — Absence favours spread of Soorai.	Harvesting: Ragi—$1/12$ Monsoon groundnut — $2/7$ Gingelly— $1/5$ Sowing: Gingelly—$1/6$	Gingelly harvested in November & December in the deltaic tract. Sown in December & January & harvested in April & May. In Arantangi sowing of Samba in November & December.

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Historical Geography of Mylapore, San Thome and Adayar

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MYLAPORE

Mylapore is the southernmost village of Madras excepting the picturesque Aḍayār suburb. Tradition makes it a very ancient village which came to have its name from the fact that Pārvati performed penance here in the form of a peacock (*Mayūra*, Tam. *Mayil*) before her eventual wedding with Śiva.[1] Historically. Mylapore is connected earliest with the great Tamil writer Tiruvaḷḷuvar whom the majority of scholars have placed in the 2nd century A.D. but whom I have assigned to the first century B.C. A temple dedicated to Tiruvaḷḷuvar is the monumental evidence of this connection of Mylapore with one of the greatest Tamil luminaries. Some scholars have identified Mylapore with Ptolemy's Malliarppa; and there is every plausibility in the identification. Ptolemy's reference corroborates the importance of the place in the second century A.D. Later records call it Calamina,[2] which has been supposed to be a corruption of Coromandal or Chōḷa-maṇḍala.

EARLY HISTORY

It is remarkable that apart from the Śaṅgam tradition, the earliest traditional fact given regarding Mylapore is to the effect that St. Thomas was buried there, giving rise thereby to the name San Thome to its eastern part. The tradition, staunchly believed in by the Catholics, is not recognized as genuine by all scholars. An extensive literature[3] has grown on the subject, the major portion of which indicates religious enthusiasm more than the critical spirit; but the existence of a continuity of tradition locating St. Thomas remains in the site over which the Mylapore Cathedral has been built seems to be a fact. Some enthusiasts see in the

1. *Educational Review*, October, 1928.
2. See Col. Love's *Vestiges of Madras*, Vol. I, pp. 287, 297 and Vol. II, p. 97.
3. Vide *India and the Apostle Thomas* by Medleycott, 1905, see note 10.

Alfred legend of a Christian mission to the east an evidence of the visit of the British Christians to the place in about A.D. 880. Still others maintain that the *Betumash* of the early Arab travellers and geographers of the 9th and 10th centuries is derived from a word indicating the Church of St. Thomas. To the Nestorian Christians who constructed the monastery on the St. Thomas Mount has been attributed the establishment of a chapel over St. Thomas' tomb; and in the 13th century Marco Polo refers to the death of the apostle from a fowler's arrow at the Little Mount and presumably his tomb at San Thome. Still later, Joseph of Cranganore (15th century) and Barbosa (16th century) mention it. Throughout this period, thus, it has been maintained, there was a small Christian colony; but San Thome became important and eventful in history only with the advent of the Portuguese in the beginning of the 16th century.

THE PALLAVA AND CHŌḶA PERIODS

It was in the early Paurāṇic age, the age when the Pallavas ruled over Toṇḍamaṇḍalam, that Mylapore came to be that prominent centre of Śaivite worship which it remains today. The temple which was constructed then and which has been lost in the later renovations, has been dedicated to Śiva under the name Kapālīśvara and to Pārvati under the name of Karpagavalli, while sub-shrines were also set up for the dancing Vināyaka and Subrahmaṇya under the name Sundara-vēl. A tangible clue to the prominence of the place we have in the psalms and traditions connecting it with the great saint Gnānasambanda. He is further said to have brought back to life the daughter of a local merchant whose remains had been kept in a vessel. A little shrine in the western gate of the temple has been dedicated to this lady, and she is seen to rise from a pot. Obviously Mylapore temple was well known in Pallava times though the buildings existing at present were later works.

There are no inscriptions in the Mylapore temple which throw light on the subsequent history of Mylapore; but a few epigraphs at Tiruviḍavandai and Tiruvoṟṟiyūr give some tantalising information regarding the place. The record[4] at Tiruvoṟṟiyūr says that, in the time of the Pallava king Kampavarman (9th century) a resident of Mayilarpil, made the gift of a lamp. The inscription[5]

4. Cg 1058 in the Topographical List of Madras Inscrns., by Rangacharya.

5. *Ibid.,* Cg. 198.

at Tiruviḍavandai says that, in the time of Rājarāja I (985—1013) a merchant of Mayilarpil in Puliyūr Kōṭṭam, gave to the local temple an endowment of a lamp. The former of these records says that the amount was deposited for interest with the assembly of Maṇali which belonged to Tiruvoṟṟiyūr. These show that Mylapore was known as Mailarpil in those days and that it was prosperous enough to have rich merchants. The villages of Maṇali, Puliyūr (near Māmbalam) and Tiruvoṟṟiyūr figure in the inscriptional records of the early and middle ages; and Mylapore was a religious centre in the midst of equally important centres of Śaivitism. The temple of the neighbouring village of Tiruvānmiyūr[6] figures in a record of later Chōḷa times in the Triplicane temple.

The Mylapore of Pallava times was also associated with the development of Śrī Vaishṇavism. The Vaishṇavite Peyāḻvār was born there, according to legend, in a well. The tradition of the identity of the well is by no means unanimous. It has been located at two places at least in Mylapore[7] and in the Pēyāḻvār Street at Triplicane as well. The tradition is of value in showing that Mylapore was not sectarian, and that people of different persuasions lived there and contributed to its prosperity.

THE PORTUGUESE ADVENT

The history of Mylapore and San Thome is obscure during the next few centuries; and we get into an era of greater light with the advent of the Portuguese. According to an inscription on a stone[8] built in the south wall of the Luz Church, Mylapore, it was built by some Portuguese in A.D. 1516. The story is that a few storm-tossed Portuguese mariners vowed to build a church to the Virgin if they were saved from the fury of the elements; that they saw a guiding light flashing out from land; that, steering towards it, they came to the shore; and that, pursuing the light further for a mile into interior, they arrived at the spot where it went out, and built there the Franciscan Luz Church or the Church of our Lady of the Light."

If the inscriptional date 1516 is genuine the Luz Church would be the earliest Portuguese monument in Madras; but its genuine-

6. *Ibid.*, Ms. 333 (241 of 1903).

7. One of these is in the Madhava Perumal temple, and another at a short distance from it.

8. It is to this effect: Fre Padro De Antougio Religio observata De. S. Franco Edificon Eston Ingraja De nossor santra Da Luz Em 1516.

ness has been seriously questioned.[9] Gaspar Correa, who visited San Thome in 1521, makes no mention of the Luz Church. He further says that Friar Pedro de Atougia was Warden of St. Francis only in 1544. An official report of 1779 assigns the foundation of the Luz and San Thome Churches to 1516 and observes that, of a number of churches built by the Franciscans the Luz Church was under their control at that time. In 1888 Casimero de Nazareth also wrote to the same effect. But the traveller Cunha Rivaro, who visited the place in 1863, refers to the 'Franciscan inscription and says that its correctness was doubtful and that it was, like the earlier portions of the church itself, a work of the 18th century. Col. Love therefore concludes that the Luz Church did not exist in 1516; that the inscription is not authentic; that it was subsequent to the rise of San Thome and developed after 1547, when a stone cross was discovered at the Mount, but earlier than 1582 as Gasparo Balbi saw it then.

The Portuguese advent to San Thome, according to the above conclusion, was earlier than the building of the Luz Church. Danvers assigns the first arrival of the Portuguese to 1504, but without authority. Gaspar Correa, who was in India from 1512 to 1561 and who has much to say about the relics of St. Thomas, seems to assign the settlement to 1522. In 1507, he says, the Viceroy Francisco de Almeyda heard at Goa from some native Christians that a chapel of the Apostle Thomas existed on the Coromandel Coast. The Viceroy sent four men to inquire about it. The information was found to be true and accordingly reported to the King of Portugal. In 1517 two Portuguese businessmen[10]—Diogo Fernandez and Bastiao Fernandez—who had visited Malacca and Pulicat, heard of the chapel and visited it. They saw there an old church-like building, 12 cubits long, with nave and aisles, and with timber roofs and pillars. "A sacristy beyond, 5 cubits long, had a dome surrounded by a dwarf spire rising to

9. As by Col. Love in his *Vestiges of Madras.*

10. The statement of Fernandez, as recorded by Rev. Vicar Gaspar Coelho, in 1543, is given in the original and English translation by Rev. N. Figueirado in a pamphlet published at Mylapore in May 1934. This pamphlet also contains two other documents on the relics and the stone cross given by Dom Frey Andre, Bishop of Cochin in 1601, on the basis of the information he gathered. The pamphlet also contains an introductory account of the connection of St. Thomas with Mylapore by the Editor and an Appendix on *The Ancient Monastery of Mylapore* by Dr. P. J. Thomas of the Madras University.

a height of 30 cubits. Crosses and peacock in plaster constituted the decoration. This structure was believed to be the sepulchre of the saint. A similar chapel, a pistol shot away, was said to mark the grave of a Native prince who had been converted to Christianity by the apostle ......" The two Portuguese reported the matter to Goa, in 1521. At the same time, Gasper Correa himself reached the place, together with a party of fifteen, and made excavations there. It is said that he discovered the remains of a prince named 'Tani Mudalayar' and a stone inscribed with the words: "I give one-tenth of income from trade both by sea and land to this Holy House, and, so long as sun and moon endure, I enjoin on my descendants to maintain it under pain of maledictions." Correa executed some repairs, and made some additions to the chapel.

In 1522, the Governor of Goa, Dom Durat de Menezes, directed a certain Manuel de Frias to make enquiries, and at the same time sent a missionary, named Alvaro Penteado, to the place. The San Thome cathedral contains the tomb of one Antonio Penteado; and this person might be a member of the family of the Padre referred to in 1522. We are told that Penteado desired to build a monastery, but got no encouragement from De Frias; and so proceeded to Goa and thence to Portugal in order to persuade the king to carry out his project. In 1623, the king of Portugal accordingly ordered a strict enquiry to be made. Meanwhile, the Portuguese Governor had sent a few men to carry out some repairs. These were now met by the agent, Manuel de Frias, and extensive repairs were carried out, besides the building of new chapels. A broken lance[11] was discovered during the excavations and taken to be the instrument with which the saint had been killed. In the same year Penteado returned from Portugal, became the local vicar, and took charge of the holy relics.

The monastic establishment founded about 1522 soon became the nucleus of a town. In 1540, the infant settlement ran a serious danger of destruction. Correa tells us[12] that, during that year, Manuel da Gama was sent from Goa as captain of the coast with instructions to dismantle the church and settlement and bring the people away. Obviously this was not done.

11. The pamphlet of Rev. Figueirado gives illustrations of the finds discovered in 1523.

12. *Vestiges*, I, p. 291.

The next date of significance in the history of San Thome is 1547. This year, the famous 'bleeding cross' at the Little Mount, with its Pahlavi inscription, was found by some excavators. A Brahman interpreted this as an archaic inscription mentioning Saint Thomas's death at 'Antenodur', and his burial at 'Maile' or Mylapore. We now know, on the authority of Dr. Burnell, that this inscription belongs to the 8th century; that it is in Pahlavi; and that it simply mentions the crucifixion of the Christ. But the Brahman's interpretation made an impression on his contemporaries, and led not only to the building of the Church at the Little Mount, but to the growth of San Thome as the reputed burial-place of the saint.[13]

The phenomenal growth of San Thome is said to have given rise, if we are to believe Manuel Faria de Souza (who published a work called *Asia Portuguesa*[14] at Lisbon in 1666-75), to an interesting episode in 1558. A Portuguese who cared more for self-respect than his religion, we are told, persuaded Ramaraya of Vijayanagar to march against the town, telling him that its plunder would be worth two millions. At the head of 500,000 men, Ramaraya is said to have marched against the place. Peter de Ataide asked the people to defend themselves in vain, and so went away to Goa. Rama Raya was received by the people with a present of 4,000 *ducats*, but he asked the citizens to produce all their valuables before him. On seeing that the total wealth was not above 80,000 *ducats*, he had the false informer torn to pieces, restored the citizens to liberty, and gave back their property. A single silver spoon which was missing was found out, and given to its owner! We do not know how far this is true.

We understand from Caesar Frederike[15] (who travelled in the East from 1563 to 1581) that, by 1567, San Thome was a big and prosperous place, with a very busy trade. This traveller observes that 'the House of the Blessed Saint Thomas' was a church of great attraction venerated even by the 'Gentiles' as the scene of the great miracles of the apostle. He describes the Portuguese city as the fairest, though not the biggest, in the Vijayanagar dominions.

13. Col. Love observes: "Correa says that a signal fire was kept burning nightly on the Mount for the benefit of Mariners, who, seeing it, 'strike their sails and make obeisance".' (*Vestiges*, I, p. 291).

14. This work was translated from the Spanish by Captain John Stevens, 1694. Col. Love quotes from it in *Vestiges*, I, pp. 243-4. Faria was not quite correct or consistent.

15. *Purchas, his Pilgrims*, Reprint of 1905, Vol. X; *Vestiges*, I, 291-2.

He dwells, with admiration, on the skill and daring with which the owners of the Masula boats carried goods and things to and from the ships of merchandise, and landed or laded them. Outgoing goods, he says, were covered with ox-hides, so that they did not run the danger of being drenched when carried to the boat.

Another Venetian, Gasparo Balbi[16] by name, who was a dealer in gems by profession, and who left Venice for the East in 1579, refers to the fortifications and churches of San Thome, indicating its growth into big dimensions. Balbi arrived at San Thome from Negapatam, after touching Mahabalipuram on the way, on 30 May 1582, and stayed there for a year. He says that the St. Thomas Church faced west, and had a low gate on the fortified sea-side which even horses could enter but with difficulty. Besides the Church of St. Thomas, which was under a Vicar sent by the Archbishop of Goa, there were three others. One of these was Franciscan, and well served by the Capuchins. Another was known after John the Baptist, and full of the Fathers of St. Paul of the Company of Jesus. Balbi says that it was built during his stay, and that a piece of timber miraculously cast out by the sea and measuring exactly what was needed for the church, was used for the purpose. He refers to another Jesuit church of the Fathers of St. Paul, dedicated to our Lady and identified by Col. Love with the Mae de Deus Church which exists even now in a dense grove of palms to the west of the high road to Aḍayār. Balbi says that 'the Gentiles' were converted and baptised largely in this church. Still other churches referred to by Balbi are those of Our Lady of Light at Luz and of St. Lazarus which has been identified with the existing church of St. Lazare a few yards south of San Thome, to the west of the road to Aḍayār and south of the Mae de Deus Church of which it is a chapel of ease even now. Balbi describes San Thome as a fair city equal to any he saw in his country. Its houses, he says, were joined in such a way as to succour one another. He refers to the native town (of Mylapore), which had mud walls, and which had an 'Adicario' who gave justice to its soldiers and other inhabitants.

THE BISHOPRIC ESTABLISHED (1606)

Till 1606 San Thome was part of the diocese of Cochin. In 1606, the bishopric of Mylapore was instituted under the jurisdic-

16. *Purchas*, 1905, Vol. X, pp. 146-8; *Vestiges*, I, pp. 292-3.

tion of the Archbishop of Goa, and Dom Fr. Sebastia de S. Pedro became its first Bishop.[17] He is called Dom Frey Sebastion of St. Peter in some records. In 1613, he recognized, in a formal grant, the great services rendered by the Jesuit order to the Church in converting numerous souls by their behaviour, doctrine, preaching and example, and acknowledged their right to the proprietorship of the Church of Madre De Dios (i.e., Mae de Deus). The Jesuit Rector at the time was Fr. Nicholas Tevente. The church and its appurtenances were in Jesuit hands till the suppression of the Order in 1775. The Bishop's stipend was about £350 per year. The first Bishop of Mylapore seems to have not only encouraged the Jesuit endeavour to convert 'the gentiles,' but to have renovated the Church of St. Thomas. From the researches of Rev. James Boyle Col. Love infers that "prior to 1552 an Augustinian church was erected a few yards to the west of the original chapel, and that, about 1606, when the bishopric was founded, the space intervening between the two buildings was roofed in. The composite structure formed the old cathedral till 1894, when the whole was demolished to make room for the present edifice, which includes within its walls the area occupied by the earlier sections."[18]

OBSTACLES TO FURTHER PROGRESS.

We have reasons to believe that the growth of San Thome would have been even more phenomenal than it was but for some troubles it had. These troubles were both internal and external. In the first place there were quarrels amongst the Portuguese themselves. Faria Y Sousa says[19] that they killed one another without any regard for human or divine laws, so that even 'the Moors and Gentiles abominated their wickedness'. Another trouble is said to have arisen from the neighbouring 'blacks', by whom we have to mean the agents of Vijayanagar, as Mylapore was at this time the seat of an Adhikāri of that State. We do not know why there was hitch between San Thome and 'the blacks'. In 1614 the latter are said to have constructed a barricade and to have thrown 10,000 shots into the place from a pagoda near St. Francis—presumably the Kapālīśvara shrine—but were compelled by Captain Emanuel de Frias to surrender their fort for want of water.

17. *Vestiges*, I, pp. 303-2.
18. *Ibid.*, p. 292.
19. *Vestiges*, I, p. 296.

THE PROSPERITY OF MYLAPORE IN EARLY 17TH CENTURY.

Mylapore is referred to by Thomas Herbert[20] in 1628. In 1635 Capt. Pedro Barretto de Rezende Private Secretary to the Portuguese Viceroy.[21] describes it as a prosperous place, under Vijayanagar. *The 'king of Bisnaga', he says, was the son of a king who* formerly ruled over the whole of Hindustan but had lost much of his power and "passed through divers vicissitudes, so much so that on one occasion he had to escape in a bundle of soiled linen which a washerman, called in these parts *mainats*, was taking to wash; and having grown up in hiding, recovered part of his kingdom by force of arms with the help of a faithful subject". De Rezendo presumably *refers to Emperor Rāma (1620-30) who came to the* throne after a celebrated war of succession following an incident similar to the one referred to by him, and described by the Portuguese writer Barrados; but the Captain seems to be quite inaccurate in his historical allusion. What he observes regarding the condition of Mylapore is very interesting. The Vijayanagar emperor is said to have appreciated peace and valued the friendship with the Portuguese though for reasons of self-interest. With business acumen the Rāya is further said to have encouraged the construction, along the outside walls of San Thome, of a number of houses in stone and mortar "with orchards producing excellent fruit." It is obvious that Mylapore had the cultivation of fruits as one of the sources of its prosperity. "All the Indian fruits can be grown here" says De Rezendo, "because the climate is good and very salubrious. The inhabitants enjoy sound health, the land is fertile, and abounds in all the necessaries of life, everything being extremely cheap." He further observes that the stuffs of Mylapore were of the same texture as those of Negapatam, and that the coloured cloths were better than the similar products produced elsewhere as they were dyed with the never-fading colours obtained from Manār and Ceylon. Mylapore seems thus to have been industrially well off in the early part of the 17th century.

20. He was Secretary to a Persian embassy, and did not personally visit South India. He was in the East from 1626 to 1629, and on account of his travels was published in 1634. Herbert says that the relics of St. Thomas were carried in 1517 to Goa and preserved there! See *Vestiges*, I, pp. 296-7 for bibliographical history and extracts.

21. *Two versions of his work are available*—one in the British Museum and the other in the Lisbon National Library. Danvers first noticed it in his 'Report on the Portuguese Records relating to the East Indies' (1892). The British Museum version has been translated by M. Lopes, Vicar-General of San Thome. Col. Love quotes from it. Vide *Vestiges*, I, pp. 277-8.

THE SAN THOME FORT.

Rezende gives an elaborate description of the fortification of San Thome and its apparently fourteen[22] bastions. The fort-wall followed the line of the houses, the doors of which were almost washed by the waves. The sea, he says, was constantly advancing in consequence of a prophecy of the saint. The wall was five yards high including its parapets which were ten spans thick at the top. On the sea face it had three bulwarks. On the north there was a bastion known after St. Dominic and protected by breastwork and artillery. On the south was a bulwark known after St. Paul. Before the northern bastion was one of the four gates of the city with a watch-house at the top, protected by two guns. Further on, was the Santiago Bastion with a postern. Then followed the bastions of Antonio da Costa. St. Augastine, and the Blacksmiths, the last of which was in the west-north-west towards the land. "Fronting the land." continued Rezende, "is the gate of St. Francis, one of the four with a new bulwark". Then comes another stretch of wall with the large bastion of Francisco d'Almeida. Further on stands that of Salvador de Resende, and then that of Joam dos Reis de Sousa. Behind this, still nearer, is the bastion of the Mae de Deus, which is in a line with that of St. Paul. These, with the breastwork and watch-house. make twelve. The bastions are built at 100 paces more or less along the sea face, and on the land side at distances of 70 or 80 paces, and all flank the walls adjacent to them." The city had 30 guns of iron and one of brass, which were from three to nine pounders. There was also another big gun which was built up. There was plenty of ammunition. The residents were all Portuguese, and numbered 120. There were also 200 'Black Christians', married and capable of bearing arms. The servants of the Portuguese were also well armed and good shots. Besides, there were 500 musketeers for garrisoning the place. The captain of the city was a nobleman in whom great trust was reposed. The city was constantly harassed by the Dutch from the side of Pulicat, 'seven leagues off'. There was no barbour for the ships, and so those sent from Goa rarely returned thither without loss and damage. Outside the town there were many Christians, 600 of whom were fishermen, and the rest servants of the city people. The former were Mukkuvans by caste, and had the reputation of good seafaring men capable of serving in the vessels cruis-

22. He is not very clear as to this number. See *Vestiges*, Vol. I, p. 300 for the plan of San Thome about 1635 after Rezende.

ing on the coast. The biggest salaried official at San Thome was the Bishop. He had a stipend of two thousand cruzadoes (£ 350) per year, paid from Goa. The Captain of the city received an equal amount. Rent was paid to 'the Lord of the soil' up to half the customs revenue of the sea gate. The clergy of the Cathedral had an income of 300 *pagodas* from a village granted by 'the lord of the land'. It was not much, but the people were well off, as living was cheap. The convents and churches of St. Dominic, St. Augastine, and St. Paul, with their orders, lived on alms within the city. "St. Dominic and St. Paul were probably near the bastions in the northern and southern faces which bore corresponding names. If so, a church of St. Dominic, now a nunnery, which stands near that of the Rosary, must be of more recent construction. St. Paul's was perhaps near the site of the chapel now called St. Rita's attached to St. Peter's Seminary." (St. Rita's was finished, as an inscription on a stone over its east portal shows, in 1740 when Father Gaspar dos Reis, born in San Thome, was the Vicar). The Augustinian church is believed to have been adjacent to the Cathedral. Besides these, there was a 'Church of Our Lady' which has been suggested to be the same as the present 'Rosary Church,' which bears the date 1635 on its portal. The churches outside the walls were those of St. Francis (probably near the gate of that name in the west), the Luz, Māe de Deus, and St. Lazare, the history of which has been already traced.

It may be pointed out that there are a number of memorials in memory of the Portuguese men and women who died for their country. J.J. Cotton gives, up to 1642, thirteen inscriptions of this character, the earliest being that of a Riuvas de Sequeila on 3 September 1557 (except the tomb of St. Thomas in A.D. 68). There is nothing of interest in these. It may be pointed out however that in one of them a Kōja (Armenian merchant) occurs. Another is that of Antonia Penteado already mentioned. An epitaph of 1635 refers to a person of importance on the Tinnevelly Fishery coast, shortly to be the scene of Xavier's labours. Altogether, the number of monuments of interest is surprisingly small.

In 1637 there took place an important event in the religious history of San Thome . On the death of the 3rd Bishop, Dom Paulo d'Estrella, the see was not filled up, and it remained vacant till 1693 when Dona Gaspar Alvares was consecrated in the revived see.

The Dutch aggressions had a grievous effect on the trade and prosperity of San Thome, as records dated in 1635 and later show.

Still, in 1637, the king of Portugal ordered 'the Captain General of Meliapore' to use every possible means to prevent the establishment of a factory by the English at Covelong, 17 miles further south.[23] In 1639, however, when Francis Day was about to plant the Madras settlement, the Portuguese were more friendly and even urged Day to establish the projected factory at San Thome itself; but this was due more to the desire to keep the British under the Portuguese control than to any real friendliness.[24] Albert de Mandelslo,[25] who wrote just at this time, says that San Thome was not very great but that the houses were of stone and well-built; that the Church had no steeple but could still be seen at a distance; that there were 600 Portuguese there besides some Armenian merchants; that as the king of Portugal sent no magistrate to keep order it was daily subject to disorders; and that Mylapore, which he wrongly located at a little distance to the *north* of San Thome was fallen from the pristine glory it had when it was the capital town of the Kingdom of Narsinga (Vijayanagar). Mandelslo refers not only to the Pagan but the Mahomedan population at Mylapore, which seems to indicate that, owing to the weakness of Vijayanagar, the Muslims were beginning to make advance into the further south of the Peninsula.

We have thus far traversed the history of Mylapore and San Thome down to the foundation of Madras in 1639. The latter fact had a direct bearing on the history of these places. The Portuguese at San Thome were invited by the new White Town authorities to settle there like Englishmen, and many took advantage of the offer. The result was the further desertion and desolation of San Thome. And it is remarkable commentary on the religious sense of the Portuguse that, within a few months of their settling in the fort, they succeeded in having the Capuchin Church of the celebrated Father Ephraim de Nevers established in the fort. The worthy Father was venerated by one and all; and always served as mediator between the English and the Portuguese of the fort as well as San Thome.

And indeed the necessity for such an interference existed from the very beginning. The nearness of the settlements could not but give rise to unpleasant relations. In October 1640 Day,

23. *Vestiges*, I, p. 303.
24. *Ibid*; O.C. No. 1718, dated 25th October 1639.
25. Mandelslo was in India in 1638-40. His *Travels* was published in London in 1669 in the form of a translation by J. Davies.

Cogan and others wrote from Masulipatam to Surāt promising not to be offended with 'the Portugalls' even if they took their cloakes or 'neerer garment.' A month later they wrote to say that Julio Munis da Silva, the Governor of San Thome, was 'of good neighbourhood'. Still, only a few days later, they wrote that the Portuguese of San Thome did their best to oppose the formation and progress of the Madras Fort, but that the progress of the fortifications had attracted 300 or 400 families of weavers, painters and other artificers to come and live at Madras thereby leading to its great expansion. In January 1642 the Surāt Agent complained to the Directors that the Portugalls' had a sinister moral influence. Many idlers, men and women, crowded from San Thome into the fort, and the influence of the latter on the soldiers' morals was by no means healthy. Once, in August 1642, three Portuguese soldiers who belonged to the Armada sent for the relief of San Thome, came into the British town, drank in an arrack-house in the company of a Dane, and, losing all balance, assaulted him and wounded him in seven places. One of the two British soldiers who were sent to prevent the scuffle was killed on the spot by Anthony Myrando, the most deadly of the guilty gang who had already committed , as he himself confessed, seven murders in the Portuguese town with immunity. The man was caught and, in spite of importunities from San Thome for his release, was shot down in the presence of the British *corps du guard.* The drastic act made the Portuguese vagabonds a little sober, and gave some immunity to the Fort. It was indeed necessary, say the Company's records; for within the few months' stay from May to August 1642 the soldiers of the Portuguese Armada at San Thome had committed an incredible number of crimes and murders.[26]

It seems that Cogan was censured by the company for establishing the new settlement. In September 1642 he and two of his colleagues justified their wisdom in a letter to the company. In the course of it they said that the San Thome Portuguese were subject at the time to the Nāyakkan of Tanjore; that he put in, almost monthly, a new Governor to collect the customs from the Portuguese; that it was impossible, on account of the greed of the Indian chief, to reside in that city; and that, above all, business men must, in order to be successful there, be stick-free and shot-free, and also such as could digest poison as it was 'the daily practice in San Thome', where there was no such thing as justice.

26. See *Vestiges,* I, p. 43.

They assured the Directors that they always tried to avoid brawls and blows with the Portuguese, and that there was no failure on their part to be as friendly as possible with them.

In 1646, we find from the records that there was a trouble which did not fortunately become serious. In that year the Vijayanagar ruler, Śrī Raṅgarāya, was overthrown by Golkonda, and the country covered by old Toṇḍamaṇḍalam changed hands from the Hindus to the Moslems. Thomas Ivie, the Company's Agent at Ft. St. George (1644-8), made himself friends with the new power. In 1646, Mir Jumla, the Golkonda General, pitched his camp in the neighbourhood of Mylapore, and undertook a siege of San Thome. Ivie placed a gunner and several soldiers at the disposal of the Moslem General. The terrible rise in prices and other hardships led to many Portuguese women leaving their husbands and families for Madraspatam. The Portuguese resented all this,[27] and a tussle followed between the two nations. Fortunately, it did not become serious. In 1647, San Thome lost 15000 people by death in a severe famine. Col. Love suggests that it must then have had four times the population of Madraspatam (about 75000).

In 1649, there was once again trouble. "According to Manucci, the Capuchin friar Ephraim wrote to Manuel Mascarenhas, Governor of San Thome, in regard to ecclesiastical abuses prevailing in the Portuguese town. Personal discussion was invited but Ephraim, on proceeding to San Thome, was seized near the Luz Church, while he was still in native territory, and dragged through the streets to the Jesuit College, where he was heavily ironed. After an interval, he was put on board ship, still fettered, and taken to Goa to be tried by the Inquisition on charges of heresy. There he remained in confinement until November 1651. Greenhill, having in vain remonstrated against this high-handed action, retaliated by arresting and confining in Fort St. George the chief ecclesiastic of San Thome." (Love, p. 101). In a letter to the Company in December 1661, the Agent refers to 'the bad conduct' of the Friars of San Thome and to the captivity of Father Ephraim; and adds that, as all representations failed, they arrested the Pādri Governor of the Convent of Friars at San Thome. In June 1651, the latter escaped, and so the hopes for father Ephraim's

27. Letter of Maximilian Bowman (26 Novr. 1646). See *Vestiges of Madras*, 1, p. 78-9. The flight of Richard Cogan to San Thome, his conversion to papacy, may be regarded as a counter stroke on the part of the Portuguese.

liberation were practically lost. The Portuguese Government, however, liberated him for the sake of peace, as they maintained. An agreement was then arrived at with San Thome, consisting of several articles, for the preservation of mutual peace. The fugitive of either party, whether slave or free, was to be resorted. If any married woman fled from one place to the other, contrary to the will of her husband, she must be restored on his request. This was not to apply to the case of a woman who did not live with her husband who was absent from his proper dwelling. A slave flying to the other place must be similarly restored to his master, and a debtor could be taken from one part to the other only when there was the certainty of safe conduct being given him by the man in whose power he was. Past disagreements and injuries were to be buried in perpetual silence as if there had never been any. From the moment of the 'signment' of these articles, they were to truly, firmly and faithfully continue in sincere love and amity! The agreement was signed by Henry Greenhill and two of his colleagues for the English, the Pādri Governor and the Captain General of San Thome, and Captain Franciscas Vera de Figueredo, a man who was known to the English and who acted as the emissary in the whole transaction, for the Portuguese. As the result of this agreement, Father Ephraim returned to Madras in April 1652.

The establishment of peace between San Thome and Fort St. George in 1652 did not after all bring about a revival of the prosperity of San Thome. Its subsequent history was one of rapid decline, thanks mainly to the progress and rivalry of the Dutch. In 1644, the Indian merchant 'Mollay' had been very loyal to the Rājā of Vijayanagar, and helped him to subdue the subordinate chiefs, as the result of which he was made his treasurer and, as the British at Madras feared, 'the Governor of all the sea-ports even to the very verge of Ceylon' The Dutch subsequently became friends with the Sultan of Golkonda who, as has been already said, took over this part of the country from Vijayanagar about 1646. The Dutch and the Moslem rulers attacked San Thome, each being desirous of being the master of it.[28] In 1662 the Moslems succeeded in starving the place into submission. The population in the

28. The Madras Records tell us that in 1656 Mir Jumla's nominee as the Governor of Poonamalli and San Thome was a Bola Rao (Balliraw). He was a source of constant troubles, like his master, to the English too. Apparently Mir Jumla's occupation of San Thome was as much inspired by the desire to control his own turbulent servant as to have the Portuguese city.

main then flocked to Negapatam in the first place and then to Madras, contributing to the numbers as well as wealth of the latter. It seems that, in 1662, when there was alliance between Catherine of Braganza and Charles II, San Thome instead of Bombay would be given as the dowry for that Princess. It is very interesting to speculate what would have taken place if this had been done. We know that they would have gladly helped San Thome against, the Sultan but for the fear of his turning against them. Francois Martin, later on the founder of the French settlement of Pondichery, who had been a resident at San Thome for twelve years before the Moslem occupation, gives a detailed account of the fall of San Thome in May 1662. This remained a MS till it was published by Col. Love, in his 'Vestiges of Madras'.

THE MOSLEM OCCUPATION AND ITS EFFECTS (1662-72).

The Moslems of Golkonda held San Thome from 1662 to about 1672, when they were ousted by the French. The place declined under Moslem occupation. A Spanish Friar of the name of Dominic Navarette, who was at Madras in 1668, says that he was refused admittance into San Thome and had to content himself with a view of its fine walls and buildings from the gate.' A Frenchman Francois L'Estra[29] who accompanied the French expedition to the Indies in 1671 writes of the Moslems in San Thome and they seem to have constructed fresh fortifications. The western gate was built after the annexation of some land further west as far as practically the present Arundel Street and this area covered three times the area of Madras. The sea-face was constructed with stones taken from neighbouring temples. The Moslem occupation led to the decline of Portuguese life in various ways. A large number of them were expelled and they had to find refuge in the fort. They received welcome from the English who, owing to the need for men in service, particularly that of defence, welcomed them. The Directors were rather alarmed at this but the Company's agents pointed out that as soldiers they were likely to be faithful owing to their hostility to 'the Moores'. According to an Indian writer of 1670 the number of Portuguese that took refuge in the fort was about 3000, while there were only 300 Englishmen. The English

29. Besides Navarette and Francois L'Estra there were others who came to Madras during this period. John Nieuhoff (1662) gives a sketch of the churches and the magnificient works of the Portuguese in the past. Thomas Bowray (1669), a free mariner, describes a visit to the Mount and its religious significance.

did not only receive the Portuguese but once at least thought of purchasing San Thome as the result of the scuffle between Winter and Foxcroft. Instructions from home were to the effect that negotiations for that purpose were to be inaugurated in case Winter refused to yield ; but his submission made it unnecessary.

THE RUIN OF ST. THOMAS' CHURCH.

The Moslem occupations also affected the fortunes of St. Thomas Cathedral and other churches injuriously. According to Portuguese records they razed the church to the ground leaving only the walls of the sanctuary, "a very narrow chapel built by the Saint himself." The church was rebuilt after 1683, when the Portuguese received permission from Golkonda to rebuild the city and. in 1893 it was pulled down for the construction of the present extensive Cathedral, the centre or transept of which was located over the Apostle's tomb.

THE FRENCH CAPTURE OF SAN THOME (JULY 1672).

We now come to a new epoch in the history of San Thome. namely, the French attack and capture of it in 1672. It was on 10th July of this year that Admiral De La Haye anchored before San Thome. He received promises of supplies from the English in the Fort, but was refused permission to land by the Moslem Governor of San Thome. As the French had been treated ill at Masulipatam by the Sultan of Golkonda, the Admiral thought that this was a favourable opportunity for retaliating on him. He therefore opened fire from the ships. and pushed through the surf to the shore. Another attack was launched on 14th July. It was successful. The town was taken and plundered, though the Moslem Governor's residence alone brought some spoils, and the *Te Deum* sung for the first time in the Cathedral. The victor was congratulated by two members of the Madras Council, sent by Governor Langhorn.

THEIR FORTIFICATIONS AND DEFENCE—WORKS

The French seem to have numbered about 600. After the occupation of the city, they took steps to strengthen the fortifications against a re-attack on the part of the Moslems. They mounted guns on the bastions, strengthened the walls on the west side (which seem to have extended somewhere between the present bazaar and Arundel Street), and founded a market outside the west gate for getting supplv from the local people. The old bas-

tions were renamed Porte Royale (in the west); Colbert (S.W. Angle), St. Louis (N. W. Angle); De Rebre (N. face); the Dauphin (north-east); Caron (south); De La Haye (south); the L'admiral (south-east); the Bourbon (middle east); the Francois and the major (north and south of the Bourbon), etc. Several extensions like the *Marin* and *Portugais* beyond the south-west bastion and the redoubt *Sans Peur* near the bank of the river (which is now a backwater) were also among their works. The fort had already extended to the west as far as Arundel Street, and from the northern entrance to the town to some distance north of the Aḍayār river. The French constructed a ditch and rampart around the Fort, traces of which are lost, " unless the masonry debris which covers the eastern slope of the sandhill on which the town is built is a relic of demolition." The French also constructed an outer line of entrenchment, with block houses at intervals. It extended to near the Aḍayār backwater, then a river which debouched at the northern end of the existing rifle range. It may be be pointed out here that the *Bourbon*, defending the middle of the east face and the sea-gate contained the flagstaff, the pole of which exists now, misnamed or misconnected with the Dutch and more probably Moslem or French.

THE FIRST MOSLEM COUNTER-ATTACK (SEPTEMBER 1672 *TO MARCH* 1673).

About the close of July, the Moslems began the counter-attack upon the French occupiers.[30] A force of 1500 men posted at Kodambakkam (literally, border village) established a blockade, and prevented the importation of provisions. On 24 August, a detachment of 2000 troops appeared in the vicinity, and set fire to detached houses. De La Haye made a sortie against them, and occupied and fortified the Kapālēśvarasvāmi Temple, which was about 400 paces beyond the western walls. On 3 September, the Moslems succeeded in investing the place. It was at this time that De La Haye demolished the houses near the walls for military purposes, and raised the redoubt to the south in order to protect the fishing village (now called Domingo street), and named it Fort Sans Peur. British Madras sent provisions, but the Moslem occu-

30. The chief authorities for these events are: Fryer, whose '*A new Account of East India and Persia*' was published in 1698; Francois L'Estra, a traveller and eye-witness whose *Relation on Journal d'un Voyage* was published at Paris in 1677; and Francois Martin's *Memoire* which is summarised by Col. Love (*Vestiges*, I, 313-6).

pied the Pārthasārathi Temple, and prevented any more supplies by land, so that it had to be sent by sea in *catamarans*. In the subsequent days, the Moslem fire was opened from the small temple near Chitrakulam. It was guided by three generals named "Babasaeb, Trimourboursouraja and Mondelnaigue", of whom the first was the chief. Much fighting took place in the area now covered by the streets of Mylapore, the details of which it is unnecessary to repeat here. It is enough to say that, thanks to reinforcement from Porto Novo, Masulipatam, etc., and thanks to their gallantry, the French were able to hold their own. One interesting incident in the midst of the engagements was the use of a big gun by the Moslems, which threw stone balls of great size. The gun was known as 'La fleche de Ram', and it was destroyed by the French for the sake of which a thanks-giving service was held in the Cathedral. One of the Moslem Generals, Mondelnaigue, was killed; and the other two, being wounded, they had to retreat for a time to 'Pondemalion' (Poonamalle). On one occasion, De La Haye destroyed the Moslem field works, and occupied the pagoda of Triplicane in the face of the protests of the British as there was then a doubt as to whether it was owned by the British or the Moslems. After occupying the Triplicane Temple De La Haye was requested by Langhorn not to take any military action in the neighbourhood, as the British claimed it. Thus, by March 1673, the French were victorious in the field.

SECOND MOSLEM ATTACK WITH DUTCH HELP (AUGUST 1673—*AUGUST* 1674).

There was peace during the next five months. During this period, De La Haye went to Masulipatam in order to negotiate a treaty with the Sultan for the grant of San Thome formally to the French. He was not successful. On the contrary, he found the place, on his return, attacked by the combined forces of the Moslems and the Dutch. It is unnecessary to give details of the military actions which followed. It is enough to say that the Dutch and the Moslems were able to put even Madras to trouble from their camp in the Triplicane Temple, from which shots were fired occasionally into the fort. The 'Moors' and the Dutch carried fire and havoc as far as the villages south of San Thome which they burnt. It may be noted that in several skirmishes in the course of these engagements the bridge now known as Barber's Bridge figured. The bridge then crossed a drainage channel, which is at present extinct except near the bridge where it has been adapted to the course of the Buckingham Canal. Often in the sight of

Triplicane, naval manoeuvres took place, and the people of Fort St. George and of the neighbourbood crowded to the shore to view the battles between the Dutch and French vessels. The gallant De Robrey, the defender of San Thome, was killed by cannon shot, and buried in the Cathedral; and his tomb is practically the only interesting monument left by the French at San Thome.[31] It is unnecessary to give details of the other incidents in the second siege of San Thome. The Moorish cavalry occupied the Luz Church, and harassed the French occupiers. The latter's position became precarious. The treasury was exhausted. Assistance was solicited from the Nayaks of Madura, 'the Duke of Ginji' (Sir Khan Lodi), and the Zamorin of Calicut. Eventually, on January 3, Martin had to leave the place for Pondicherry, of which he was destined to be the maker. Blockaded by Dutch ships at Triplicane, with no money to pay the soldiers, with no provisions obtainable in spite of skirmishes into the enemy's quarters, subjected to losses by cyclone, deserted by sailors, men and even leaders, De La Haye had eventually to write to the Dutch officer, Pavillon, at Triplicane, suing for peace. It was concluded on 24 August 1674. By it De La Haye was to surrender the place, but to be allowed to depart with all honours of war, and given even facilities for being taken to France. The Treaty caused annoyance to the Moslems, as it was concluded with the Dutch and not themselves; but the Dutch gave San Thome a few days later to Golkonda. Abul Hassan invited De La Haye to enter his service, but he declined. He reached France in May 1675, to be received well by the king and die in his service.

THE SULTAN OF GOLKONDA DESTROYS SAN THOME FORT (1675).

The handing over of San Thome to the Sultan of Golkonda in 1674 was followed by the demolition of the fortifications which had been built by the various rulers in the past. It may be mentioned that Governor Langhorn was very much interested in moving the Sultan to do this work of destruction. There was a proposal in December 1674 to restore it to the French for a lakh of rupees. The Dutch, however, persuaded Madanna, the celebrated minister of

31. Col. Love notes with surprise that though many officers and men must have been buried at San Thome during the French occupation, there is not a single monument extant. I may draw attention to the fact that the European tombstones found in the innermost parts of the Triplicane temple were obviously placed there during the time of the French occupation.

Golkonda, to oppose the scheme with success. It was this failure that led Martin to found Pondicherry in the ground granted by Sher Khan Lodi, on behalf of the king of Bijapur a few months back. Thus, thanks to the endeavours of both the English and the Dutch, San Thome and its fortifications were ordered to be destroyed by the Sultān. Even the churches and principal buildings were included in this vandalistic work; but fortunately, there was some check to the work of destruction shortly after. The "interposition of the Moslem Governor of San Thome, who represented that the demolition of so fine a town would be contrary to the royal interests and would also prove a costly operation," led to their being spared. Langhorn supplied 200 able coolies for the purpose of demolition, but did not take a very active part, as he was afraid of embroiling the Company with the French and the Portuguese who, for historical reasons, had claims on the place.

INDIAN INFLUX INTO MADRASPATAM.

Thus ended the military episode of French occupation and Moslem conquest of San Thome. One result of it was a large influx of Indians of the place to Madras. Their advent led to the building of houses in such a way as to give rise to the Right and Left Hand caste disputes in 1698 and later on; but Madras prospered, and took the place of San Thome as the primary city of trade in this part of the world. The inhabitants of San Thome,—the Portuguese, Moslems, Hindus and people of other nations—were exceedingly poor, and there was no hope of the place ever recovering its ancient glory. Even the very stones of the destroyed fortifications helped the English in renovating occasionally their works in Fort St. George.

THE BRITISH NEGOTIATIONS FOR RENTING SAN THOME OUTWITTED BY THE PORTUGUESE (1677-84).

In 1677, Governor Streynsham Master negotiated with Golkonda for renting outlying villages like Egmore, San Thome and 'Tiruvatore'; but was not successful in gaining his object. The Sultān had given it in farm to the well-known merchant Verona. In 1678, Master renewed the attempt. The minister, Madanna, said that he would grant the prayer provided a payment of 3000 pagodas was made for the issue of the grant of the rentals of San Thome and Egmore. The sum was paid, but still the negotiations fell through. In the meanwhile, Lingappa, the Governor of Poonamalle, prevented the free importation of grain into the city, and his Collector

of the customs gave notice that he would not permit any goods or provision to come into Madras. Master had to assert his right by force, and pull down the houses of the watchmen of San Thome and Triplicane. When Verona's tenure ended in 1684, Master made still another effort. He was now prepared to check the growth of a Moslem San Thome, in case it was not granted or leased to him, even by force. As a matter of fact, the serious obstacle arose from the Portuguese residents of Madras who wanted to get the place back from the Moslem and settle there once again. Indeed, in 1687, they hoisted their flag at San Thome, thinking that their object was already attained. But in 1688 the kingdom of Golkonda was conquered and annexed by the Mughals; and Governor Yale entered into negotiations with the Grand Mughal. As the result of this, San Thome, together with certain dependent villages, was promised to the Company for a rental of 3000 pagodas per annum. At the last moment, however, the Portuguese snatched the prize and outbade the English. The Portuguese thus once again settled in the dismantled and ruined city. As a matter of fact, their power was confined to the European quarter, and they were tyrannised by the Mughal Havildār.[32]

ANGLO-PORTUGUESE HITCHES AND MOSLEM REOCCUPATION.

The Portuguese occupation of San Thome caused unpleasant relations between them and the English. In 1694 a criminal fled into the Portuguese town, and the English demand for his surrender was refused. Thereupon Governor Higginson ordered the arrest of any San Thome Portuguese in Madras. Hitches like this[33] followed; and on January 8, 1697, the affair was settled by the Mughal officials from Arcot occupying San Thome themselves! The fortifications which had been left undemolished were now completely destroyed, and the materials were useful as quarries for the neighbourhood. Thus passed away for ever the Portuguese part in the history of San Thome. The Portuguese dwellings are now surrounded by Muhammadan houses, and the Portuguese ceased to count for ever. In 1702 Diwan Muhammad Sayud built a rampart of earth round the Moslem and Portuguese quarters. Perhaps it was in his time that the streets Poṅpalli, Chinnapalli etc.,

32. In 1694 the Havildar or Governor, whose jurisdiction extended as far as Pulicat was Haji Muhammad Ali.

33. See *Vestiges*, I, p. 575 for examples.

arose in San Thome as the result of the large number of Moslem parts which came into existence.

RELATIONS BETWEEN THE FORT AND THE RESIDENTS OF SAN THOME

In 1700 a remarkable quarrel arose between the Bishop of Mylapore and the Council. Bishop Gasper Alfanso, the fourth of the line (1693-1708), sent a notification to the Pādre Friar Michael Angeles in the Fort, asking him to read certain things on pain of excommunication. The Council resolved that the Bishop had no power whatever over the clergy or laymen in Madras. To prevent irregularities in future, the Council ordered that neither the then Pādre nor his successors could read any paper directed by any Bishop without the sanction of the Governor. In 1701, a Roman partiarch who arrived at Pondicherry sent some presents of chocolate, oil and wine to the Madras Governor, and asked Pādre Michael to present himself at Pondicherry. Pitt accepted the presents, but ordered the missionary not to go. The result was, the Bishop of St. Thome placed the Capuchins of the Portuguese Church in the fort under an Interdict. The quarrel lasted for years, till in 1715 the Capuchins recognized him. Similarly, in the time of Governor Pitt, several strikers who took refuge in San Thome were supported by the Nawāb's agent, and Pitt threatened to retaliate.

HISTORY FROM 1700 *TO* 1749.

The first half of the 18th century saw the growth of the Nawābs of the Carnatic. The period ended with the Carnatic succession war, the rise of the French, their capture of Madras and their eventual fall. In 1749 San Thome was granted to the English. The same fate befell Mylapore, the main Moslem City. In 1709[34] Governor Pitt had requested Siyāuddin Khān, the Steward of the house-hold of Shāh Ālam, who was known to Governor Pitt, and whose wife was living at San Thome, to give him the town of Mylapore and 'Tiruvattore' pointing out that, while they were of no use to the Emperor, they would be of great value to the business of the Company.. Mylapore was not however granted at that time; but 'Tiruvatore' Nungambakkam, and three other villages were granted for 1,500 pagodas per annum. Mylapore therefore had continued to be the seat of a Moslem Havaldār, and very often the

34. See *Vestiges*, Vol. II, p. 21.

Nawāb was there. In October 1749, however, the English[35] eventually obtained it from Nawāb Muhammad Ali, whose Diwān Sampāti Rāo played a conspicuous part in the transfer. In the same year Mambalam and several other villages were, as has been shown elsewhere, also acquired.

(To be Concluded)

35. *Ibid.*, p. 291.

The Use of Pictures in Teaching Geography

A Talk to Teachers.

By

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There is no need for me to stress the value of pictures in teaching geography, or indeed any subject. Children take a natural delight in pictures, and in using pictures we are only enlisting the child's own natural predilections. Seeing, learning and enjoying may easily be combined into one process in the child's mind by a teacher who knows how to use pictures correctly in her lesson.

Apart from the natural pleasure of children in pictures, there are other advantages in their use that will at once occur to you.

Pictures convey correct ideas, where a description might be misunderstood. Teachers in England who have to teach the Bible, for instance, could give many examples. I am quite sure that many an English person, reading the story of a lame man who picked up his bed and walked away with it, pictures the recently cured cripple as staggering along under a great four-poster bed, with the mattress and blankets and pillows. No English child can think of a bed except in the form of an iron or wooden bedstead. To sleep on a mat on the ground would be an impossibility in the English climate. For such children a picture would at once convey something that mere descriptions could never give. In the same way, Indian children are likely to misunderstand descriptions of life in England, which would immediately become clear if a picture were shown.

Further, these correct ideas are quickly conveyed by means of a picture. The attention of the children is much more easily secured. What is even more important, the information thus obtained is generally retained. Recent experiments conducted in America seem to prove that lessons taught by a cinema film was remembered much better than those taught in the ordinary way. If we try to think back ourselves to childhood's days, I am sure some of our ideas would still clothe themselves in the form of pictures seen very long ago. I believe that if, for example, you were to ask me what a canyon was, the word would suggest a

picture of the Grand Canyon of Colorado that was in my school geography book, rather than the real canyons I have seen in more recent years. So strongly are impressions held. when conveyed in picture form in childhood.

These then are the advantages of using pictures. The children enjoy the lesson and are more attentive : they gain correct ideas quickly and are saved from obtaining erroneous impressions. What they learn through pictures they are likely to retain.

These advantages, however, must not blind us to the fact that pictures by themselves are not sufficient. They must be supplemented by descriptions. A picture is an appeal to the eye alone. It represents an object in a static condition at a single moment of time. A picture of a tropical forest, for example, may show us the colours and the forms of trees and plants. It cannot convey to us the heavy scents of the flowers, the damp smell of undergrowth, the constant flicker of light and shade. The forest is not still ; it is full of busy life. Myriads of living creatures are going about their business, and some creatures not so tiny. The forest is not silent either. At night, even more than by day, it comes to life. It may seem to be quite still, but if you have ever spent a single night in the depths of the jungle, you will know that it is full of sound. Patches that appear to be shadows , or bushes or the tree-side, when closely watched, reveal themselves surprisingly as deer or other animals, so cleverly concealed by this background that only the keenest and most experienced eyes can detect them. Now these impressions can never be given by a picture. The picture at best is only the supplement of a good description. In the same way, a picture of a desert, with its bare spaces and stark shadows, may give some impression of the heat and emptiness of the desert by day ; but of the intense cold at night ? What of the mirage that lures the traveller on ! These cannot be shown in a picture. A picture of an iceberg gives a very good idea of what an iceberg is like, but not even a cinematograph can reproduce the peculiar colour, the strange green-blue that changes moment by moment as the great monster comes swiftly across the ocean. It certainly cannot reproduce the icy blast that comes down with the icebergs from the cold northern waters. A description must certainly accompany the picture.

Pictures have many advantages, but they have their limitations. The teacher who has provided pictures for his or her class has not thereby done all that is necessary.

Pictures for use in teaching geography may be divided into three main groups: large pictures, for use during the lesson, which must be clear enough for every member of the class to see. smaller pictures, which may be hung on the wall for the pupils to see after the lesson, or even as ornaments; and finally very small pictures for the pupils to use individually. If the school has a lantern, or an epidiascope, of course, quite small pictures may be enlarged so that the whole class may see them at one time.

The geography teacher must always be on the look-out for material in the form of pictures. Large pictures will generally have to be specially bought. Some may be made or copied by a teacher who has a liking for drawing and some skill in art. Smaller pictures are obtainable in all sorts of ways. Children must be set to collect pictures just as they collect objects for the school museum. Newspapers, magazines, calendars, advertisements, picture postcards, the wrappers of tins and packages, will all provide material. Many governments, municipalities and railway companies also issue beautifully got up books and pamphlets. A large and interesting collection can thus be easily gathered. The teacher who has a camera can be on the look-out for suitable subjects. Now the whole value of such a collection—and this is most important—the whole value of the collection lies in its orderliness and availability for use. Half a dozen pictures, thoroughly understood and selected with a definite purpose in view, are of infinitely more value to the teacher than a drawer full of miscellaneous pictures which have never been classified or arranged Mount your pictures and classify them—the pupils can very well do this. As material accumulates, and possibly becomes excessive, old and worn pictures can be rejected; and others re-classified. The essential thing is to know what pictures you can have or where to find them.

The small pictures must be carefully sorted and classified. They can then be arranged in books, according to subjects. Loose-leaf books may be easily made in the hand-work class, or letter files may be used. Some pictures will serve more than one purpose. For instance, a view of the Swiss Alps may be required for a lesson on Switzerland, a lesson on mountains, or a review of Europe. Another way of using small pictures is to mount them in the form of zig-zag books. The classification may be done in any way useful to you. Each book may represent a country, or a continent, or natural features such as mountains or river valleys. Occupa-

tions make another classification, such as rice-cultivation in different countries, wheat-lands in North America, Europe and Asia, and so on. The important thing is to know what you have and be able to find it when required. All this is work which the pupils themselves will gladly do. As material accumulates, it should be weeded out, so that the collections are always manageable.

So much for collecting materials. Now comes the problem, how to use it.

Certain principles are necessary, whether we use large pictures for class demonstration, or small ones for the individual children.

The first is, do not show too many pictures at a time. Two or three are enough. If the children are given too many they will only retain a confused memory. This does not mean there is no place at all for the cinema film or for the showing of a set of slides on certain occasions. But I am now dealing with actual lessons on specific themes. For such lessons, two or three pictures are quite sufficient. Secondly, see that your pictures do illustrate exactly what you want them to illustrate. You must decide before you use the pictures exactly what purpose they are to serve. Ask yourself, " What does this picture show ? Does it show it clearly enough ? Does another picture show it better ? " The pictures that are left mounted on the wall or in albums for the pupils to study after the lesson should not only have the title, but should also state quite clearly what they are supposed to show.

Thirdly, have a definite place for studying the pictures selected for the lesson. I will say a little more about this later. Just now I want to say a few words about how to use pictures in the actual work of teaching.

1. Certain typical scenes may be mounted and framed and left permanently as decorations in the class-room or geography room. These need not be very large pictures, but they should not be too small. Under this head would come scenes taken from the big regional divisions of the World, such as a typical hot desert, a tropical forest, and so on, or some of the main occupations such as rice-growing, lumbering, wheat-fields, etc. These are things which every geography course, whatever the syllabus in use, is likely to include. Such illustrations may well therefore be kept permanently in view for constant reference.

2. The large pictures should be mounted on cloth or cardboard. They may be used at the beginning or the end of the lesson, or in the course of it. Vary the procedure. The teacher,

for instance, might show a picture, or two or three pictures, of life in Japan. When the children have sufficiently studied the pictures, the teacher may then allow them to give their impressions. The teacher's business will then be to gather up or arrange what the children themselves have found out. On the other hand, the teacher may give the lesson, as we say. In this kind of lesson the teacher begins, say, with a little boy or girl of Japan, shows the picture and describes it. Then will follow his house, with a picture to illustrate it, and then perhaps pictures of his father and mother, Japanese children at play, and so on. The third method is to introduce pictures at the end of the lesson, gathering up and focussing all that has been said.

Small pictures are difficult to use in class-teaching. If you have a number of copies of the same picture it is easier, but even then the teacher can never be certain that all the children are looking at the single point in the picture. They are very useful for children to study in their free periods. A set of small pictures may sometimes be passed round at the close of a lesson.

It is well sometimes to have several illustrations of the same thing. A mountain, for instance. There is no really typical mountain, and if you want to avoid teaching the children to think of one particular form only as a mountain, it is necessary to give several pictures of mountains. Other examples will occur to you when several pictures are really necessary.

But there are other ways of using pictures. Pictures make excellent examination questions and revision tests. The teacher may show a picture and ask the class to write a description of it. After a lesson, or a series of lessons, on a particular country, or commodity or other subjects , the class may be given pictures and asked to answer certain questions by way of revision. I have not myself seen a picture used in an examination paper, yet this type of question has been used in other countries, and is specially useful in the early stages. There is no reason why you should not introduce pictures into your class and promotion tests. Suitable pictures would be those of Eskimos, a Canadian wheat-farmer, Arabs drawing water from a well or other people from the main regions of the world. Suitable questions would be, "Look at the men (or women, or children) in the picture. In what part of the world do they live ? How do they obtain their food ? How do they travel ? " At a later stage a little more may be demanded, and rather more difficult pictures may be used. For still more

advanced pupils, questions on land forms, rivers, surface-relief and similar subjects may well be based on pictures.

Another type of question would be to show a fairly wide stretch of country and ask the pupils to describe the view they would obtain from a given point, or to describe what they would see if they walked from one given point to another. The grand result of such questions is that they pin the pupil down to particular and actual things. Geography may so easily consist of generalities and definitions. A test paper set in this way will compel the pupil to be definite and to refer to actual facts, and the teacher will see at once whether the child really understands what he has learned or is merely reproducing something that he has learnt by heart.

Pictures may also be shown without titles and the children asked to say what country, etc., they represent. Pictures previously shown, with similar ones added may be shown again by way of revision or testing, or both together. In this way, the memories of the children are refreshed and the teacher at the same time can find out what facts have remained most prominently in the minds of the pupils. For this kind of exercise larger pictures may be used and the whole class take part. Pictures may also be used as observation contests—to see which side can find out the most facts in a given picture.

Books of pictures may be kept for use on rainy days when some pupils cannot go out to play, or for free periods. The children can then choose their own books and look at the pictures as they like.

Another use for pictures, although I do not propose to discuss this in detail, is to make them the basis of geography handwork, or other craft activities. Costumes may be designed and made, and dolls dressed, models built and so on. With young children particularly, time must always be given for such activities, and pictures are essential for this work.

A very important use for pictures is in connection with maps. Here again it is very easy to take refuge in generalities. By maps I mean all kinds of maps, not only physical. Take climate, for example. How easy it is, for example, to draw a map showing so many inches of rain on one side of a mountain range, and so much on the other side, and how glibly pupils can answer questions on climate. I remember very well, years ago, in the Vosges moun-

tains in France, how striking it was to see the vineyards climbing up one side of the mountain and the pine forests up the other side. If I had seen it represented on a model or in a map, I am sure I should have thought it was a little artificial, made to illustrate a theory. Yet it was there before my eyes in actual existence. I probably learnt about such things at school, and drew rainfall maps, but I never really grasped the extraordinary contrasts that could exist on the two sides of a mountain range, until I saw it for myself. Most of us, and certainly most of our pupils, will have to be content with pictures of most of the world. Let us see to it that not only Standard II with its stories of children in other lands, but equally the VIth Form studying erosion and climate and other abstruse branches of geography, have plenty of pictures. Speaking of erosion reminds me of a cinema film I saw not long ago in which what had been among the richest farm lands of Canada and the U.S.A., were shown literally blowing away. It was a terrible picture, and could not be forgotten. In the same way, as far as possible, physical maps should be compared with actual photographs of the country represented. If you have a lantern, the two, picture and map, can be shown together in an ideal way, both drawn on the same slide. But even without a lantern, pictures and maps can be shown together to the class. Especially is this method useful when teaching contour maps.

Earlier this evening I said that a picture by itself was not sufficient. It must be accompanied by description. This is where the teacher has to play an important part. Showing a picture to the class does not mean that the teacher may do less preparation but rather that he or she will have to do more. The teacher with a picture before the class cannot take refuge in generalities. You may talk quite convincingly about, say, the prairies of Canada —great stretching plains, scattered towns, lovely farms, and so on. All quite correct. And the pupils will reproduce it. Put up a photograph of a lovely prairie station. At once you are pinned down to actualities. What is that strange building ? No such building can be seen in India or even in England. What is that little box nailed to a post near the railway line ? What is that machine actually doing ? Perhaps the description with the picture is sufficiently exhaustive to answer all these questions. Very likely it is not, and the keen eyes of the children will pick out some detail that you will have to explain to them. The teacher who uses pictures therefore needs to know a great deal more and to make more useful preparation than the one who relies on generalities, and who thinks that if children learn a definition their

How is the teacher to obtain this information? Firstly, by reading. Secondly, by reading. Thirdly, by reading. And when you have done that, read again. Read newspapers. Read magazines. Read travellers' descriptions. Read guide books. Read novels. Recently the newspapers and magazines were full of descriptions of the visit of the King and Queen to Canada. Of course they travelled under special conditions, but nevertheless those articles provide a great deal of material for building up a mental picture of Canada. In the same way, some great events in some parts of the world may call forth a number of newspaper and magazine articles that will furnish up-to-date knowledge. There are good geographical magazines that deal in popular fashion with countries and people and occupation and industries. Especially I commend to you the reading of novels. Frequently a good novelist who sets his story against a background will import into his descriptions an emotional content that makes them far more alive even than a traveller's description. His canvas will be small, of course; only large enough to make a background for his characters to move and live, and possibly only one section of the people may appear, but remembering these limitations, we can add very considerably to our descriptive ability by careful study of the best novelists of the present day. Of course we shall not look to Dickens for a description of London or to Thackeray for modern Virginia. Recently I read an English translation of a very long Russian novel. Most of it was painful, even unpleasant, reading, but I received an impression of a certain part of Russia that cannot be compared with anything I had previously read. Similarly, a magazine that I had picked up quite by chance gave me a picture I had never before possessed of the annual breaking of the ice on the Vistula. Moreover, the world is constantly changing and our information must be up-to-date. So I would say, read and read and read again. A geography teacher who does not read, or who reads only the prescribed text-book, will only become staler and staler, and not even the brightest of pictures will make his or her lessons anything but stale.

Now we have to remember that a child does not necessarily see in a picture just what an adult sees. All our past knowledge, all our previous experience, are focussed on the picture as we look at it. When we look at a picture we see it coloured by the emotions born of past experience but not evoked by the picture. Let me give you a somewhat extreme example. The thing which to me, to me, I repeat, most recalls the spirit of the great prairie lands of Canada is the letter box nailed to a post at lonely

cross-roads or near a tiny railway station. So scattered are the lonely farms that no postman could visit them and deliver his daily letters. So at some point on the road a box is fixed up wherein the postman may place the letters for the farm and where he will find the letters ready for him to carry back to the post office for mailing. A picture of such a box at once calls up to me the idea of the loneliness of the farms and the great distances between them. I think of the people who will come to take their letters from that box. Here is a farmer, perhaps, who long ago fled from persecution and danger in Central or South-Eastern Europe. His children are growing up free Canadian Citizens, and he takes from the box a letter in a language his children cannot read, sent by friends and relatives from that old land in which his childhood days are spent. Or a young man comes, just starting a new life, but eager still to receive news from his parents in their cottage among the hills of Scotland. I could look at such a picture, simple as it is, for a long time, and image after image would come into my mind. But show that picture to a child and ask him what he sees, a box, nailed to a post. His literal mind may even lead him to count the nails by which it is fastened. He may tell you the box is crooked, and if pressed, will search for still further details to recount. The real significance of any picture is likely to elude the literal mind of the child. Therefore in preparing the lesson a definite plan must be followed. The essentials must be brought into prominence. In the lesson this can be done by discussion or description by the teacher. Other pictures which the children examine out of class must be adequately described and the essentials brought to their attention.

Two other aspects of this subject I should like to mention. One is the opportunity of teaching appreciation of the natural beauty of landscapes in colour and form. A landscape may be represented on a map, or by a picture. A map gives us very little idea of the beauty of a countryside, though a geographer who has seen much of the world and who is skilful at reading maps may, by putting together what the maps tell him of rainfall, climate and the physical conformation of the country gain some idea of the picture it presents to the eye. Pictures, however, especially coloured ones will reveal many of the beauties of the world. Pictures of the beauties of landscape may evoke in children a desire to protect that beauty.

Finally, pictures are a means of cultivating the imagination. Children naturally think in pictures. Adults tend to lose this

ability. But it is something well-worth preserving, and to the teacher of geography, a necessary asset. If you have lost it, you must regain it to be a successful geography teacher. For your pupils it is just as necessary, and a skilful use of pictures will enable them to retain this precious attribute of childhood.

Select Contents

The Geographical Journal: July 1939

Exploration in the Lesser Sunda Islands—By H. A. Brouwer.

Practical Regionalism in England and Wales—By E. W. Gilbert.

The Geographical Journal: August 1939.

The Polar Front and its Place in Modern Meteorology—By C. K. M. Douglas.

The Geographical Magazine: August 1939.

A Hundred Years of British Farming—By Prof. J. A. Scott Watson.

The Saxons of Transylvania—By Christopher Hankey.

Giant Fish Traps of Siam—By W. B. M'Quitty.

The Modern Indian of the American South-West—Dr. Ruth Underhill.

The Geographical Magazine: September 1939.

Australians at Home—By Michael Terry.

Free China's New Gateway—By Gerald L. G. Samson.

Places and Products: VIII. Portland Stone—By J. E. Mallory.

A Mountaineering Adventure in the Karakoram—By R. A. Hodgkin.

The Scottish Geographical Magazine: July 1939.

The Natural Vegetation of Scotland: Its Character and Development—By H. Fairhurst.

Human Geography, History and Sociology—By Prof. C. Daryll Forde.

Geographcial Review: July 1939.

Agricultural Land in Proportion to Agricultural Population in the United States—By Richard Harshorne.

The Soils of the Tropics: A Review—By Robert L. Pendleton.

Indian Information Series: August 1, 1939.

New Iron and Coal Deposits in India: Gold Prospects.

Proceedings of the Royal Geographical Society of Australasia, South Australian Branch for 1937-38.

Monsoonal Australia—By J. A. Prescott.

The Value of Geography to the Community—Dr. Charles Fenner.

News and Notes

Three meetings of the *Association* were held during the quarter in which three lectures were arranged for teachers of Geography. On 29-7-'39, *Miss E. D. Birdseye* gave a talk on "*Asking Questions in Geography*"; on 19-8-'39, *Mr. N. Subrahmanyam* lectured on "*Map Work in Teaching Geography*"; and on 9-9-'39, *Mrs. P. S. Sundara Raj* spoke on "*The Use of Pictures in Teaching Geography.*"

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The new Elementary School Syllabus in Geography recently issued by the Department of Education has been found to be unsatisfactory; and protests have been raised against its introduction in several quarters. We have no doubt that the Director of Public Instruction, to whose notice the matter has been brought, will take early steps to get it suitably revised.

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There appears to be a general feeling that *the S. S. L. C. Geography* is in urgent need of overhauling; and we could point to some of its objectionable features, such as unequal mating with History, with no means of knowing the candidate's performance in the Public Examination, with only an hour's paper to meet which difficulty short tests have been introduced, study of pure regional geography only to the neglect of General Principles (Part IV of the original syllabus being omitted); and now comes the latest reform in the shape of the portion for the public examination being confined to Eurasia only to the neglect of the other continents (which form a 'B-Group' within the subject). In short the 1929 scheme and syllabus have by successive tinkerings become in 1939 very lop-sided indeed. Probably it is not opportune to ask for or attempt any change now, as the Reorganisation of Secondary Education is now on the anvil and everything will go into the melting pot.

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It is pleasing to note that at long last the Madras University *Diploma Course in Geography* has come to be popular, as measured by the strength of the class this year. It is hoped that it will continue to be so at least until such time that Colleges provide for teaching Geography in the Degree Course. The Geography Departments of Training Colleges have now a better chance of getting

students qualified in the subject, and schools a better chance of having fully qualified teachers of Geography.

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As few Andhra students have so far taken advantage of the training afforded by the University Diploma Course in Madras, it is desirable that the *Andhra University* institutes its own Diploma Course so that Andhra graduates seeking admission to the Geography Department of the Training College, Rajahmundry, may get the requisite preliminary qualification in subject-matter before undergoing the teachers' training.

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We are glad to note that the *University of Mysore* is taking further steps to implement its former resolution to introduce Geography by bringing into their academic bodies draft schemes for Intermediate, B.A., and B.Sc., Courses with the intention of starting it at the Intermediate stage in the Academic year 1940-41 and carrying it right along.

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Arrangements for holding the *27th Session of the Indian Science Congress* at Madras in January 1940 are proceeding apace; and the Executive Committee and the various sub-committees of the Reception Committee are busy working out the preliminaries. Among the longer excursions to be organised in connection with the Congress are those to Mahabalipuram, Gingee, Mettur Dam and Madura, besides short local ones.

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The proposal for an *All-India Geographical Society*, mooted first at the Calcutta Session of the Science Congress in 1938 has not so far materialised itself; and there has been little response from the several provinces and states, the chief reason being probably the absence of strong Geography Departments in most of the Indian Universities. It is hoped that in the coming session of the Congress at Madras, some progress may be made towards the realisation of the proposal.

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Closely connected with the previous question is the urgent need for an *All-India Geographical Journal*, which can well be the organ of such an All-India organisation. Geographical research is yet in its infancy in this country; and it is only through societies and magazines that a proper fillip can be given to it.

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The XVth All-India Educational Conference will be held at Lucknow (and not at Patna as originally decided), on December

27-30, 1939. *Dr. Sir S. Radhakrishnan* will preside over the Conference. An All-India Educational Exhibition will be held along with the Conference in connection with which excursions will also be arranged.

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The Report of the *Patna College Geographical Society* for 1937-39 shows a record of useful activities carried on under the direction of its energetic President, Prof. Z. Ahsan. Among the extraordinary meetings of the year is an interesting debate reported in it on "*Flood Control in Bihar*", presided over by Mr. J. B. Sen, Parliamentary Secretary to the Government of Bihar.

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While some parts of the country like Bihar and Bengal have problems connected with flood control, Madras in common with certain other drier parts of India have problems of their own, suffering from the vagaries of the monsoon. The water-supply of Madras and certain other towns is threatened; while famine conditions prevail in the country-side.

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The principal map production office of the Survey of India, *the Photo-Litho Office*, whose machines pull out annually more than 3,000,000 impressions valued at over Rs. 3,00,000, celebrates its jubilee this month (September). Of the original contributions of this office, mention may be made of the direct zinc printing process, now known throughout the world as the "*Vandyke Process*", which was evolved at this office, and is named after the late Mr. F. R. Vandyke, Manager of its Lithographic Branch, who was responsible for the discovery.

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A grim war has broken out in Europe, whose magnitude, developments and repercussions are too early now to gauge. The map of the Continent is being re-drawn, though no one can forsee at present the shape that it will finally assume. Various and far-reaching will be the effects of this war in most countries of the world.

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Says *The Times of India*, in a recent issue:—"From India's point of view, there is one great difference between this war and the last. In 1914 the industrialisation of the country was in its infancy and the cutting off of European supplies of manufactured articles meant complete dislocation of our economic life.

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"To-day, however, conditions are different. Indian industries have made vast strides in the past two decades. To mention only

a few staples; India is now virtually self-sufficient in such important commodities as cement, sugar, soap, matches and shoes. She has also considerably expanded her production of other essential articles: iron and steel, cotton textiles, paper, chemicals, rubber products (tyres, etc.), the simpler types of electrical equipment (bulbs, switches and fans), and so on.

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"The result is Indian economy has not been gravely dislocated by the war. On the contrary, if she can manage to buy the necessary machinery and plant from the United States, there is every chance of a number of new secondary industries being established in the near future * * * * Here is a big opportunity for Indian enterprise".

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Reviews

Beginning Geography in Africa and elsewhere. By V. L. Griffiths and Abd el Rahman Ali Taha. (London, Evans Bros., Ltd.), price five shillings.

In reviewing this book a geography teacher is tempted to begin by stealing Mr. Fairgrieve's summing up from the Foreword and say that "it is extraordinarily good geography and it is extraordinarily good teaching. It is easily the best book of its kind that any teacher of juniors can obtain, and while it was written in and for schools in the Sudan, its principles and methods can be adapted readily to any other area".

Syllabus makers and teachers in India are very keen on what they were pleased to call "local geography". It is certainly local, but in my experience it is rarely geography. To learn the names of all the stations on the S.I.R. main line by heart is not exactly geography, though it is exactly what I have heard in school. Children do not need to come to school to learn the way from their house to the bazaar. The real purpose and value of teaching local geography is abundantly made clear in this book. Further, the way to teach it is dealt with in great detail. It is easy to put down in the syllabus, "visit the local market", or the post office, or the mosque, but I have yet to meet the village teacher who knows how to make such a visit into a real geography lesson. In this book such visits are made into lessons full of interest and profit. None of the small but so often baffling problems that confront the ordinary teacher of the ordinary junior class seems to have escaped the attention of the enthusiastic but essentially practical authors of this admirable book.

The connection between geography and civics is clearly brought out, though unfortunately the pundits who have settled the course which our elementary schools must now follow seem to find such a closer connection between civics and human physiology than they do between civics and geography.

The series of lessons on map making is remarkably clear. It is here more than anywhere that the average village school entirely misses its opportunity. Step by step the significance of a map is unfolded, and it is safe to believe that children will not leave the Sudan schools thinking that the North is somehow the top of the world or that North America is about the same size as their local

district because the wall maps of the two areas are the same size. The present reviewer, looking back over the junior classes she has taught is only sorry that such a book as this has never come her way before. It is full of stimulating and helpful ideas and it makes clear some of these difficulties that teachers contend with year after year without solving them. No book could better serve its particular purpose that this does, and no training school should be without a copy. Although it is called, " Beginning Geography," teachers of senior scholars could not read it without profit to themselves and their classes. In short, it is a book that cannot be too highly commended.

The World in Outline. By E. D. Laborde. (Cambridge University Press). Price, 6sh. 6d.

This is a text-book of world geography suitable for use by candidates in secondary schools preparing for the School Certificate Examinations. Though the Continents are arranged in the conventional order, the teacher can take them in any order he likes, as there is no gradation of difficulty in treating them. The characteristic features in each land mass have been specially emphasised; and the treatment is comprehensive, clear and interesting. The skeleton outline of physical geography appended at the end can serve for revisional purposes after the world study is completed. A special feature of the book is the copious illustration in the shape of numerous simplified sketch-maps, special diagrams and good pictures. When the Matriculation takes the place of the S.S.L.C. Examination in Madras, as it is shortly expected to do in the proposed reorganisation of the Secondary Education, whatever be the syllabus, so far as the study of the regional geography of the world is concerned, the volume under review can serve as an admirable text-book.

The World. By Thomas Pickles. (London, J. M. Dent & Sons.), 1939. Price 4sh. 6d.

This text-book of world geography provides a survey of the world, which must form the main body of any secondary school course in Geography. The volume is divided into two parts: the first part deals with general world geography, the topics treated being the following:—the world as a globe, the major natural regions, land forms, map-making and map-reading, and sources of power and metals. These fundamental topics are presented less in an academic way and more in a manner calculated to arouse

the interest of the pupils by e.g., introducing some illustrative details from common experience to explain some of the more difficult topics. Similarly, in the study of the natural regions, instead of presenting at the outset a complete, complex and confusing map, each region is introduced by a special map, while subsequent maps revise and extend the knowledge thus gained. Again in the study of each natural region a few typical products have been dealt with instead of a long and wearying series of world distributions.

The second part of the book provides a rapid survey of the outstanding features of the regional geography of the continents —Europe the most complex continent being placed last. But as there has been no grading according to difficulty, the sequence can be altered to suit any school course. The volume is well illustrated with a number of good sketch-maps, charts and pictures ; and is suitable for use in high schools.

Modern Geography—Book I : Foundations of Geography. By D. M. Preece and H. R. B. Wood. (University Tutorial Press, London). Price 3sh. 6d.

This is an excellent text-book of general geography, dealing with the essential principles of both physical and human geography, and forms a good companion volume to regional geography books. In fact, as the Preface states, it is " the first of a series of six books designed to meet the needs of pupils, preparing for the school certificate and other examinations of similar scope." We wish to state, however, that it would have come in better as the last book of the series ; or what amounts to the same thing, that it is studied at the end of a good course of regional geography in school, though the principles may be learnt progressively each year of the course. For the Intermediate Course, however, it affords an admirable foundation for further advanced study of the subject. The treatment is systematic and comprehensive ; and the volume is copiously illustrated with useful maps, diagrams and pictures.

Lands beyond the Border. By Dewan Bahadur H. L. Kaji. (Humphrey Milford, Oxford University Press, Indian Branch), 1939. Price Rs. 3.

This companion volume to the author's Principles of General Geography is original in its conception of giving to Indian students a synthetic idea of lands beyond the Indian border and across the

Indian seas. In recent years there has been evinced in this country a growing interest in the lands adjacent to it and in those which have a special connection with Indians. The book under review is, as the author says in the Preface, " an attempt to place within the easy reach of the student a small volume which provides material not only for a geographical study, regional and economic, of these countries, but also discusses briefly their progress and problems with special reference to the interest they have for India ". *The Indo-centric perspective, as opposed to the Brito-*centric, planned in the Introduction and worked out in the volume is refreshingly original and should make it peculiarly interesting to Indian students of Geography. Beyond the land border, countries from Arabia to Japan have been brought within the purview of the book ; and across the seas lands of the Eastern sea-board of Africa from Egypt to South Africa as well as Ceylon and East Indies have been included. Australia has naturally been left out of lands of Indian interest. Both for its right perspective and its clear treatment, the book may be read with profit by students of geography in Indian Universities.

Collins—Longmans Study Atlas. By K. H. Huggins, J. M. Parrish, D. A. Workman and J. C. B. Redfearn. (Wm. Collins Sons, & Co., Glasgow & Longmans, Green & Co., London), 1939. Price 3sh. 6d.

Planned, compiled, drawn and produced under the direction of a joint advisory hoard of experts—a geographer, a technician, an educationist and a cartographer, this Study Atlas gives extraordinary good value for the price. In producing it their one aim is stated to be " the presentation, in a simple form in which they can be easily assimilated and used as a basis for all school geography, of a careful selection of the most significant facts about the earth as the home of man ". And this aim, we are sure, has been admirably fulfilled. It is pleasing to enumerate below some of the several good features of this excellent school atlas :—

1. Precision and clarity of all details.
2. Stress on areas and regions rather than on boundary lines.
3. Omission of dispensable details.
4. Several double-page maps to show relationships better.
5. Seven-colour printing, affording a greater range of pleasing tones without confusing the eye.
6. A uniform system of colour layering.
7. 26 photographs to provide vivid illustrations of geogra-

phical aspects which cannot adequately be expressed in words or maps.

8. Double-page world maps presenting fundamental facts of general world geography.
9. A summary diagram to bind together information from the separate maps in relation to the major regions.
10. About 1,100 exercises, designed to familiarise the student with the uses of the Atlas.

The substitution of an Indian section in place of the extensive section on Britain in an Indian edition should make this valuable atlas still more valuable for use in Indian schools.

The Southern Continents and North America (in Telugu). By Eva D. Birdseye. (Macmillan & Co., Madras), 1939. Price 12 as.

This is the first volume of a series, prepared in accordance with the recently revised S.S.L.C. Syllabus in Geography issued by the Madras Educational Department. The authoress, who is an experienced teacher, has treated the subject in a simple and practical manner with proper emphasis on essentials: and the language is simple and clear. The exercises given at the end of each chapter help to revise as well as to supplement the matter; and references are given to additional reading from original sources. The book is illustrated with a number of useful sketch-maps, diagrams and pictures.

Food, Clothing and Shelter Series: Book I (in 3 parts also); *Hunters, Shepherds and Farmers* (Tamil), 3½as., 4as., 4as.

Providers of Food, Clothing and Shelter: Book II (in 3 parts also), (Tamil), 3¼ as., 4as., 4as. By Mc D. Robison (Macmillan & Co.).

These are Tamil editions of the Geography books in English by the same author reviewed in a back number of this Journal recently. They form an admirable series of graduated reading books in geography for elementary school children, written in easy Tamil, printed in bold type and well illustrated. A novel and helpful plan is followed in all these books. Each lesson is divided into two parts: In the first part certain information is given in order that the pupils may acquire geographical knowledge; in the second, exercises are given to test and fix

this knowledge, which may later be applied by the pupils to problems of ordinary life.

These books have been specially written for pupils with little or no experience of varying lengths of daylight during the year, and of the intense cold and stoppage of plant life during winter. Ceylon instead of England has been used as the home of the pupils; but the books can be used with great advantage in Tamil schools of South India as well, as the climatic conditions are exactly similar, variations in seasons being expressed more in differences of rainfall than of temperature.

Cost of Living in the Co-operative Villages. By the Audit Union of the Workers' Agricultural Co-operative Societies, *Ltd.* (*Tel-Aviv*, Palestine).

This is a brochure issued by the Audit Union of the Workers' Agricultural Co-operative Societies, at Tel-Aviv in Palestine, giving a statistical and closely reasoned account of the researches carried out in 38 out of 82 Jewish villages in which co-operative agricultural farming is carried on. The cost of the main items of living in these villages is compared with that in some of the older countries like Bulgaria, Poland, Sweden and U.S.A.

The following statement regarding the adaptation of the dietary of the Jewish immigrants to geographical conditions is very interesting :—" In Northern and Central Europe the consumption of meat, milk and potatoes ranks high. In the Mediterranean countries these commodities have a rather limited consumption and are supplanted by a high consumption of bread and vegetable oils. This is natural, as this region is famed for its olive oil, while the cultivation of potatoes is centered in Northern and Central Europe. On the other hand, the goat is the commonest domestic animal in the herds of the Mediterranean countries, whereas in Northern and Central Europe the cow predominates, hence the disparity in the consumption of milk and meat. In addition, the colder climate tends to increase the consumption of foods of animal origin, while the warmer climates tend to raise the consumption of vegetable foods.

" Geographical conditions are also responsible for certain other characteristics in the diet of the farmers in different countries—as for example in the high consumption of fish in Italy.

" With regard to the Jewish co-operative villages, these occupy an intermediary position between the diet of farmers in Northern

Europe and those of the Mediterranean countries. This is only natural, inasmuch as to a great extent they are natives of Europe —Poland, Germany, etc., who have settled in Palestine, a Mediterranean country.

"They arrived here with dietatic habits of European origin, a product of European climate and conditions, i.e., a high demand for potatoes and foods of animal origin, and are now gradually adopting a typical Mediterranean diet of oils, vegetables, and fruits as a substitute for meat, potatoes, etc."

Regarding the development and establishment of the co-operative villages, the book concludes that "the members of the villages are gradually adapting themselves to local conditions, and after the first years of suffering and privation they at last reach a stage where they can provide themselves with the necessities of life to at least such a degree as the farmers of highly developed agricultural countries, as Switzerland and Holland. * * * * * * Thus we may say, in summing up, that the co-operative villages have gone far towards economic stability, and that it is hoped such progress will continue to be made."

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The Physical Aspects and the Geology of The Neighbourhood of Madras

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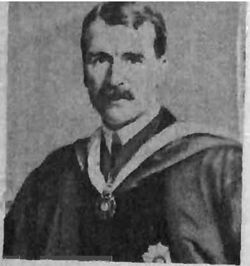
INTRODUCTION.

This article is an attempt to give a brief Survey of the Geology of the Neighbourhood of Madras to Geographers, Geologists and others. The limits for such a description have been arbitrarily taken as the district limits of the Chingleput district. The first part deals with the physical aspects, as they are very essential in bringing out their close relationship with the Geological features.

It has been too frequently suggested, even by persons occupying responsible positions, that the neighbourhood of Madras has very little to offer in the form of Geological interest; the author's aim in writing these few pages will be more than achieved, if he has succeeded in showing to such persons the vast field of Geological interest, which goes almost unheeded near the very place of one's residence. It is also hoped, that this article will be of some help, in arranging excursions to places of Geological interest, to students of Geology and Geography.

ACKNOWLEDGEMENTS

The author's indebtedness to the host of workers, who had so very keenly and enthusiastically endeavoured to study the area and to record their observations, especially, to the pioneers in the field of Indian Geology in the Presidency, R. Bruce Foote, William



SIR THOMAS HOLLAND, K.C.I.E., who was attached to the Geological Survey of India for only 21 years (1890-1910), during which period he was Director for eight years, had a unique official career in that he had revolutionised the methods of Petrographical Study by his descriptions of the Charnockite Series near Madras, and the Elaeolite and Corundum Syenites of Coimbatore of the Madras Presidency.

WILLIAM KING, Esq., B.A., D.Sc., F.G.S., who was for some time Director of the Geological Survey of India (1887-1894) was an officer of the department for about 37 years. He was for 20 years Superintendent in charge of South India, and as such had made very valuable contribution to the Geology of our Presidency.

ROBERT BRUCE FOOTE, Esq., F.G.S., who had been attached to the Geological Survey of India for over 33 years (1858-1891), surveyed in collaboration with Dr. King almost the whole of the Madras Presidency and the south-western portion of the Bombay Presidency — a joint record unsurpassed by that of any two other members of the Geological Survey. His work covered an extensive field of *not only* the various branches of Geology, but also prehistoric archaeology. On retirement, he

King and Sir Thomas Holland, whose work forms a sure foundation for all later workers, will be apparent in almost every page. The author wishes to thank all those, who have gladly and readily lent photographs to illustrate the article as the Director, Geological Survey of India; Mr. B. M. Thirunaranan of the University Department of Geography; and Mr. S. Narayanaswamy. His sincere thanks are also due to Mr. V. Kalyanasundarum, of the Department of Geology, Presidency College, Madras for kindly typing the article for the printer from a not very legible manuscript.

BOUNDARIES AND ADMINISTRATIVE DIVISIONS.

District Boundaries.

The district of Chingleput including the Madras city, is bounded on the north by the Nellore district, on the west by the Chittoor and the North Arcot districts, on the south by the South Arcot district and on the east by the Bay of Bengal. The northernmost limit touches latitude of 13° 42′ 23″ N. near Sulurpet and the southern limit 12° 13′ 49″ N. on the banks of the Ongur river or the Athangarai Ar—a distance of about 102 miles north to south; the eastern and the western limits are at longitude 80° 20′ 40″ E. at Kattupalli about eight miles south of the village Pulicat, and 79° 33′ 38″ E. at about 10 miles W. N. W. of Conjeeveram town respectively. Hence, the extreme length is about 100 miles N—S and the breadth at the widest place is about 47 miles E—W.

Administrative Divisions.

Leaving aside the Madras city, which is the capital of the Presidency, and which is 9 miles in extreme length and 4½ miles in extreme breadth, the district is divided into seven taluks for purposes of political and revenue administration; the Saidapet taluk immediately surrounds the Madras city stretching as far as the Ennore backwaters in the north, Tambaram in the south and Tinnanur on the west. To the west of it lies the Tiruvallur taluk; to the north of both of them the Ponneri taluk; immediately south of the Saidapet taluk is the Chingleput taluk while to the south west of the former lies the Sriperumbudur taluk; west of Chingleput taluk is situated the Conjeevaram taluk and Madurantakam taluk forms the southernmost of all. These administrative divisions have no basis or connection with either the physical or physiographic features or on the geologic structure of the area, except that in certain taluks the rivers form a natural as well as political boundary for some distance as (1) the north-eastern boundary of Madurantakam taluk follows the lower course of the Palar;

(2) the southern boundary of the same taluk is fixed by the Ongur or the Athangarai river; (3) a portion of the eastern limit of Conjeevaram is the Palar river; (4) and the southern frontier of the Ponneri taluk for some distance follows the Arani or Narayanavaram river.

MORPHOLOGY AND RELIEF.[1]

Scenery.

The general aspect, as characteristic of a coastal belt is flatness with a gentle slope towards the east or seaward, dreary near the sea and undulating and rarely hilly elsewhere. The general level ranges from below the sea level near some of the break-waters gradually up to 300 feet above the mean sea level in the western parts of the Conjeevaram and Tiruvallur taluks. There is not much in the way of scenery in the Saidapet, the Tiruvallur and the Ponneri taluks, except where in the extreme north and north-west of the Ponneri and the Tiruvallur taluks, the Kambakkam—Nagalapuram ranges, the Satyavedu hills and the Allikkuli hills contribute a little mountain scenery. The character of the first two hill ranges consisting of quartzites of Cuddapah age has been described as "bluff ridge and beetling Crag" with ridges here and there steeply starting up into sharp tapering peaks. The tops are generally bare, and the more gently sloping surfaces are clothed with coarse grass and jungle. The climate of the Kambakkam Drug is not in the least disagreeable, and was once thought to be suitable for European settlement. There is plenty of vegetation and excellent, cool, crystal clear water including a beautiful bathing pool. The best time of the year to visit it is immediately after the N. E. monsoon *i.e.*, in January; it is a place excellently suited for excursions—geological and geographical. The place appears to have been once occupied by the Poligars,[2] whose chief built the fort, the ruins of which may

1. The following One Inch Survey of India sheets comprise the District under review:—57 0/11, 0/12, 0/14, 0/15, 0/16, P/9, P/10, P/11, P/13, P/14, P/15, P/16; 66C/2 & 6, C/3, C/4, C/7, C/8; 66D/1 & 5, D/2, D/3 & 4.

2. Poligars, who were mostly Naiks, were the hereditary chiefs, who had jurisdiction over the various southern kingdoms under the suzerainty of the Rajah of Vijayanagar during the latter's time; they were, however, later recognised by the English ever since their first settlement as responsible for maintaining the peace of the country; in return they were allowed to levy petty duties on various food stuffs. (Vide: An interesting account of them by Dr. E. Asirvatham, Madras Tercentenary Commemoration Volume, pp. 167-172).

be seen at the present day. The fort fell later, into the hands of the Nawab of the Carnatic, who built his summer palace there in order to enjoy the fine air and the beautiful scenery. Though no fruit cultivation is to be seen there now, the place appears to have grown once the best oranges of the Carnatic; the climate decidedly is suited for the cultivation of oranges and plenty of limes are cultivated at present in comparatively poorer areas, as around the Allikkuli village.[3] As the elevation of the Satyavedu and the Allikkuli hills is much lower consisting of huge boulder conglomerates of Upper Jurassic age laid on the gently sloping shore of the Cuddapah quartzites or the Peninsular gneiss there is practically no scenery to be observed in them; here and there, vertical conglomeratic precipices and apparent stacks may be seen taking all kinds of fantastic shapes; the area is covered only with scrub-jungle. The Conjeevaram taluk is also marked by little to relieve the dreary monotony which characterises it; there is an entire absence of scrub jungle or forests except sporadic presence of tamarind and palmyra trees, while near the Palar river they are replaced by the cocoanut palms. But parts of the Chingleput and the Madurantakam taluks decidedly offer rather pleasing undulating plains, varied by ridged or conical ellipsoidal hills rarely exceeding in height 600 feet; the higher hill ranges are covered with thick scrub jungle and the smaller ones are usually rocky and barren of vegetation. Parts of the Madurantakam taluk appear to be well suited for mango and cocoanut groves, the last in the S. E. part of the taluk.

As one would expect in the case of coastal continental slope receiving the terrigenous debris for many geological periods, the regions bordering the sea are flat, tame, dreary and uninteresting, consisting of marshes, lagoons, small bays and backwaters. Besides, these are the result of the blocking up of the drainage at the mouths of rivers by the continued action of the epigene agencies, as the rivers bringing sediments, mostly during the monsoon times, the prevailing sea currents and wave actions heaping up sand bars, and the wind action in distributing the sand to form dunes over wide areas. As one proceeds inland from the coast, one first comes across a rather high sandy ridge of blown sand forming the shore for one, two or even three miles, then a shallow extremely saltish or brackish water lake or lagoon; and that passed *terra-firma* begins, which is also flat and uninteresting. During the rainy season the area is almost impassable being intersected by rivers and drainage streams,

3. Vide: Col. Monteith—A Visit to Cumbaucum Drug, Mad. Jour. Lit. and Sc., July 1836, pp. 134-138.

swollen, muddy, miry and dangerous to be crossed. Marshes are to be seen near the mouths of rivers, while further on, on either side are the lagoons and backwaters. The coast line which is approximately 96 miles in length, is straight and sandy, the sand forming a belt of varying breadth up to three miles. The general trend of the sand bars, and the shapes of the submarine five and ten fathom contours indicate that the prevailing current and wave action are as equally responsible for their formation, as the other epigene agents, as river and wind action.

The principal of these lagoons, which are of all sizes, is the Pulicat lake, and is situated in the Ponneri taluk between the Chingleput and Nellore districts. It has an extreme length of about 37 miles and a breadth varying from 3 to 11 miles. The river Arni or the Narayanavaram embouches near Pulicat, forming first a series of swamps, next a mostly dry sandy lagoon partly filled with sea water, and then a sand bar rising to a height of about 10 feet above the sea level. This shoal is said to be fairly dangerous to ships from the north, and a wide berth must be given especially during night time.

From the mouth of the Narayanavaram river to that of the Korttalaiyar near Ennore, there is a very big long partly dry lagoon communicating with the sea only near Ennore. Only this narrow eastern portion is occupied by bitter sea-water, and the remaining area is either dry or marshy or miry, and is used as salt pans for the manufacture of common salt. It is likely that during the monsoon times these lagoons may become brackish, when the rivers and channels draining into them will be full. The Ennore backwater extends as far as Edayanpalaiyam, three miles W.N.W. of Tiruvottiyur, but it must have extended still further southwards to north of Madras in the recent geologic past.

South of Madras also the same phenomenon may be noticed in a narrow elongated lagoon extending from three miles north of Covelong to about three or four miles south of the Seven Pagodas or Mahabalipuram. The sea enters only to a small distance both at Covelong and near Edaiyur four miles S.S.W. of Mahabalipuram. The rest of the area is occupied either by swamps or by dry areas converted into salt pans. There is no doubt, that this lagoon must have extended a few miles northward, and also southward connecting with similar lagoons south of the Palar river near Cheyur, through the small lagoon situated immediately south of the mouth of the Palar, but must have been separated by the Palar alluvium after its change to its present course. Further south, one finds

again rather extensive lagoons in Yedyanthittu Kaliveli and the Kaliveli tank; a good portion of the former is dry and partly converted into salt pans, while the latter though dry appears to be a slightly brackish water lake during the rainy season. The piece of land called Yedakainadu[4] or left hand land south of the lagoon near Cheyur, bounded on the east by the sea and the Kaliveli tank on the south appears to have been separated from the main land by an irruption of the sea. The land itself consists purely of alluvium, and it must have been converted to dry land due to accumulation of coastal debris both in historic and in geologically recent times. This explains its rather fertile sandy soil excellently suited for the cultivation of cocoanuts, which are the best produced in the district.

The Buckingham Canal.[5]

The above mentioned natural features have been taken advantage of in the construction of the Buckingham canal running all along the coast of the district, and still further north as far as Pedda Ganjam in the Guntur district, and as far as the Kaliveli tank or the Markkanam tank in the South Arcot district by cutting through the various high grounds between the lagoons or backwaters.[6] The canal was dug piece-meal from time to time, and the first eleven miles from St. Mary's or Hutton's bridge in the City northward called the Cochrane's Canal was dug in or earlier than 1806. By 1837 it was extended to the northern extremity of the Pulicat lake and this portion was called the Kantapilli channel. It was continued further northward in the next twenty years, so that by 1857 it was cut as far as Dugarazpatnam in the Nellore district, and it was called the East Coast canal. By 1877, as a relief work during the famine of 1876-77, it was extended as far as Krishnapatnam, a distance of about 114 miles from Madras. The next year saw its extension to its present limit namely as far as Pedda Ganjam, a length of about 196 miles from Madras, and it was called the Northern Canal. In the City, the canal runs for a small distance along an old river, the Elambore river, just west of the General Hospital and

4. "It is called Yedakeinadu or left hand land, and tradition points to its having been separated from the remainder of the taluk by an irruption of the sea."—C. S. Crole—The Manual of the Chingleput district, 1879, p. 128.

5. *Vide,* for an interesting account V. K. Sourirajan, Jour. Mad. Geo. Assocn., Vol. III, 1928-'29, pp. 106-120.

6. From Pedda Ganjam the canal becomes a fresh water one called the Commamur canal, traversing further inland and joining with the Kistna river at Bezwada.

George Town, as could be easily made out by its width and volume of water in this portion.

The section south of Madras, called the South Canal, was excavated between 1852 and 1857 from the Adyar to the mouth of the Palar, an approximate length of 41 miles; this was extended in 1882 to the Markkanam backwaters.

The connection between the South Canal and the East Coast Canal or the Northern Canal in the City was made only in 1876—77, as a famine relief work. Just south of the General Hospital forming the northern arm of the Cooum, the Canal utilises a portion of an artificial channel excavated in order to change the course of the Elambore river further westward to provide for more space for the strengthening of the fortifications of the Fort St. George, during 1754-1779.[7]

The Canal was once very useful, and even now to some extent, in facilitating easy and cheap transport of food stuffs and heavy goods which can be transported leisurely. But with the advent of quicker and fairly cheap means of transport as the railway and the motor lorries, it is not so much used at present. Yet, it forms the chief means of transport for fire-wood (*Casuarina equisetifolia* lamellibranch shells for burning into chunam, rice and paddy, avaram bark (*Cassia auriculata*), building stones and to a small extent timber.

The following observations may be noteworthy in a study of the coastal features near Madras :—

1. Lagoons and marine or salt-water lakes seem to be present almost continuously along the coast; their general shape is elongated parallel to the coast line.

2. The breadth of the lagoons appreciably decreases and they altogether disappear near the mouths of rivers; this is manifestly due to the sediments brought by the rivers. Hence, the geological history of coastal towns, as Madras, depends largely in the unravelling of the stages in the filling up of the lagoons.

3. The drying up of the lagoons has given rise to salt deposits, and a good portion of the area has, hence, been converted into salt pans for the manufacture of common salt; the sandy

7. *Vide*, F. L. Conradi's map of 1755 of old Madras reproduced in Vol. III, Jour. Mad. Geog. Assocn., as Map VII of Prof. C. S. Srinivasachari's article, 1928-29.

coastal belt is far from being a fertile area, suitable for the growth of only *Casuarina* (providing fire-wood for the city of Madras), Palmyra, Cashewnut, Pandanus, and other thorny bushes and coarse grass. The land is, hence, very cheap resulting in plenty of space being available for a growing town as Madras.[8]

4. The big bulge in the coastal alluvium between Pulicat village and Ennore, and a relatively smaller one at the mouth of the Palar are remarkable. The former makes us conclude, that some bigger river than the Korttalaiyar must have embouched near and north of Ennore—the old Palar or Vridhakshiranadi.

5. The interesting growth of sediments at the mouths of rivers (a) at the mouth of the Narayanavaram river a sand bar running in the direction of the prevalent currents; (b) the peculiar shape of the five fathoms submarine contour off Ennore and the less pronounced ten fathom contour forming what appears to be a submarine bar; (c) a small bulge, which is more marked in the five fathom contour at the mouth of the Adyar and a slightly bigger one at the mouth of the Cooum as shown by the ten fathom contour; this is, probably, due to carrying off and deposition of the finer materials of the city's refuse; (d) an indented bulge in the five, and in the ten fathom contours off the mouth of the Palar; the bulge is not exactly situated opposite its mouth.

6. The presence of two reefs, which are dangerous, close to the shore between Covelong and the Seven Pagodas,—the one on which the carved temples stand, and the other three miles north of the Seven Pagodas—at a distance of about 25 miles south of Madras. This is very remarkable in a straight sandy coast as that of the East coast of the Peninsular India, extending for about 1,200 miles from the mouth of the Ganges to Cape Comorin; the only other places, where the rock outcrops near the coast, are between Ganjam and Vizagapatam where four such ledges are recognised[8a] Near the former place the East India Company's ship *Rockingham* was totally wrecked in 1776.

8. Cf. Bombay and Calcutta—L. W. Lyde: "The Continent of Asia", 1933, p. 471. "The one merit of the city itself is that, as the poor land was not valuable, there was little demand on it, and so—for an eastern city—Madras is widely spread and openly spaced."

For this reason Madras is often described as a City of distances.

8a. S. W. Cushing, The East Coast of India, Bull. Amer. Geog. Soc., Vol. XLV, 1913, p. 90.

7. The accumulation of sand just south of the Madras harbour forming a wide beautiful beach for Madras city, probably entirely due to and later than the building of the Madras Harbour, as the result of interference caused by the harbour wall to the prevalent currents.[9]

HILLS AND MOUNTAINS OF THE DISTRICT

The various hills and ranges of the district may be considered according to their situation in the various taluks; and as already mentioned one can see some really beautiful mountain scenery only in the Kambakkam—Nagalapuram range, situated in the northernmost part of the district, immediately after the N.E. monsoon. Elsewhere, the hills and ranges are not high enough either to give rise to good scenery or an appreciable change in the climate. The hillocks consisting of very ancient crystalline gneisses of the Peninsula to be seen in the Saidapet, Chingleput, Sriperumbudur, Conjeevaram and Madurantakam taluks frequently occur in groups: that these oval or round usually barren hillocks are the stocks of very ancient folded chains may be inferred from their rather regular arrangement in roughly N.E. to S.W. direction.

9. G. G. Armstrong—Mad. Tercen. Comm. Vol., p. 211.
F. E. Penny: On the Coromandel coast, p. 23.
Hodgson: "T. Parry, Free Merchant", p. 14.
C. S. Srinivasachari: Jour. Mad. Geog. Assocn., Vol. III, p. 105.
G. Kuriyan: Mad. Tercen. Comm. Volume, 1939, p. 313.
No map of the area before the building of the Harbour in 1881 shows the wide expanse of the sand south of it.

The more interesting mountains of the district are given in the tabular statement below :—

Name of Mountain or Hill.	Height of the highest point in ft	Position of Highest point. Latitude.	Longitude.	
Ponneri Taluk.				
Kambakkam Durgam.	2539	13° 34′ 27″	79° 51′ 40″	The Kambakkam--Nagalapuram--Ramagiri range is a continuous one with a trend of N.N.W.-S.S.E. in the northern portion and gradually swerving N.N.E.-S.S.W. in the southern part. The Kambakkam Durgam can be reached from the village Varadayyapalaiyam. In both the places there are Forest Rest Houses.
Nagalapuram peak.	2891	13° 26′ 23″	79° 46′ 40″	Both the peaks are situated in the Nagalapuram hills, the Ramagiri malai being the southern. There are several less high peaks some of which are accessible from Nagalapuram.
Ramagiri malai.	2839	13° 25′ 40″	79° 45′ 20″	
Ambakkam peak.	708	13° 22′ 10″	79° 52′ 43″	Accessible from the south-east from the village Pudukuppam.
Satyavedu peak.	930	13° 28′ 7″	79° 53′.43″	This is in the western part of the ranges and is nearer to and also accessible from Tripurantakapuram. Both the Ambakkam and the Satyavedu peaks are situated in the Satyavedu ranges.

Name of Mountain or Hill.	Height of the highest point in ft.	Position of Highest point. Latitude.	Longitude.	
Tiruvallur Taluk.				
Allikkuli eastern Peak.	1020	13° 17′ 47″	79° 48′ 10″	The Allikkuli range forms the southern continuation of the Satyavedu ranges separated from the Satyavedu ranges by the Arani river.
Allikkuli N.W. Peak.	1052	13° 19′ 7″	79° 45′ 40″	
Allikkuli S.W. Peak.	1254	13° 17′ 0″	79° 43′ 57″	
Sriperumbudur Taluk.				
Malaipattu hill.	458	12° 54′ 53″	80° 0′ 50″	These hills are to be found on the eastern portion of the taluk and are interesting in that they form the eastern limits of the Jurassic formation.
Erumaiyur hill.	378	12° 57′ 13″	80° 4′ 33″	
Conjeeveram Taluk.				
Kunnavakkam hill.	339	12° 50′ 50″	79° 54′ 5″	This is the only hill to be found in the Taluk being situated in the eastern border of the Taluk; this forms the S.W. limit of the Jurassic formations.
Saidapet Taluk.				
St. Thomas Mount.	250	13° 0′ 13″	80° 11′ 40″	All the hills from St. Thomas Mount to the Vandalur hill, are arranged in a rough N.E.-S.W. direction.
Pallavaram hill.	499	12° 58′ 10″	80° 9′ 45″	
Tirunirmalai hill.	198	12° 57′ 47″	80° 6′ 57″	
Another hill N.E. of Tirunirmalai at a distance of about ½ mile.	265	12° 58′ 0″	80° 7′ 28″	
Mullu malai.	321	12° 56′ 53″	80° 6′ 47″	These hills are to be seen N. and N.E. of Tambaram village.
Pachai malai.	360	12° 56′ 37″	80° 7′ 38″	
Tambaram hill.	440	12° 56′ 8″	80° 6′ 27″	
Vandalur hill—	563	12° 53′ 47″	80° 5′ 48″	

Name of Mountain or Hill.	Height of the highest point in ft.	Position of Highest point.		
		Latitude.	Longitude.	
northern peak.				
Nanmangalam hill.	230	12° 55′ 30″	80° 10′ 38″	These are to be seen further east of the group St. Thomas Mt.-Vandalur mentioned above.
Sittalapakkam hill.	266	12° 53′ 3″	80° 11′ 43″	
Ottiyambakkam.	150	12° 51′ 33″	80° 11′ 22″	
Chingleput Taluk.				
Vandalur—southern peak.	113	12° 53′ 23″	80° 5′ 23″	
Nedugunram hill.	349	12° 52′ 50″	80° 6′ 30″	East of Vandalur hill.
Guduvancheri hill.	431	12° 49′ 50″	80° 3′ 43″	The Guduvancheri-Karaikalani range includes also the hillocks between them.
Karaikalani hill.	364	12° 48′ 40″	80° 3′ 14″	
Appur hill.	500	12° 48′ 10″	79° 59′ 10″	This may be called Appur---Venkatapuram group with the hillocks between these including the Venpakkam hill.
Venkatapuram hill.	457	12° 45′ 47″	79° 58′ 25″	
Venpakkam hill.	352	12° 46′ 13″	79° 57′ 10″	
Tirukkachchiyur hill.	301	12° 46′ 27″	79° 59′ 37″	These form the Tirukkachchiyur-Settipunyam-Kandalur range.
Settipunyam hill.	836	12° 44′ 53″	79° 59′ 0″	
Kandalur hill.	405	12° 43′ 23″	79° 58′ 47″	
Hanumantaputter hill.	782	12° 40′ 40″	79° 58′ 3″	S.W. of Chingleput town.
Tirumani hill.	769	12° 39′ 3″	79° 58′ 47″	S. of Chingleput town.
Alappakkam hill.	415	12° 40′ 15″	80° 0′ 10″	These form the Tirumani-Alappakkam-Vallam---Kunnavakkam---Angur range.
Vallam hill.	686	12° 41′ 30″	80° 1′ 22″	
Kunnavakkam hill.	702	12° 42′ 23″	80° 1′ 7″	
Angur south peak.	615	12° 42′ 53″	80° 2′ 44″	
Angur north peak.	590	12° 43′ 20″	80° 3′ 0″	

Name of Mountain or Hill.	Height of the highest point in ft.	Position of Highest point. Latitude.	Longitude.	
Alagusamudram hill.	341	12° 38′ 23″	80° 1′ 13″	These form the Alagusamudram--Nemmali--Porundavakkam---Santhakuppam-Ramamalai-Agaram-Kalway range.
Nemmali hill.	567	12° 40′ 3″	80° 1′ 44″	
Porundavakkam hill.	515	12° 40′ 33″	80° 2′ 33″	
Santhakuppam hill.	386	12° 42′ 50″	80° 4′ 10″	
Rama malai.	501	12° 44′ 13″	80° 5′ 10″	
Agaram hill.	291	12° 45′ 23″	80° 6′ 7″	
Kalway hill.	301	12° 46′ 23″	80° 6′ 50″	
Kumili hill.	548	12° 48′ 0″	80° 6′ 50″	These form the Kumili-Ammanampakkam-Nallambakkam---Unamanjeri group.
Ammanampakkam hill.	420	12° 49′ 0″	80° 7′ 20″	
Nallambakkam hill.	367	12° 50′ 33″	80° 7′ 13″	
Unamanjeri hill.	226	12° 51′ 10″	80° 7′ 53″	
Tirukkalikkunram.	470	12° 36′ 37″	80° 3′ 38″	These form the Tirukkalikunram-Talambedu-Oragadam-Edakunram-Mailai-Vembedu group.
Talambedu hill.	706	12° 36′ 53″	80° 2′ 13″	
Oragadam hill.	431	12° 38′ 0″	80° 3′ 57″	
Edakunram hill.	253	12° 41′ 18″	80° 6′ 10″	
Mailai or Kattur hill.	295	12° 42′ 35″	80° 7′ 15″	
Vembedu malai.	246	12° 44′ 40″	80° 8′ 10″	
Madurantakam Taluk.				
Karunguli hill.	420	12° 32′ 10″	79° 53′ 27″	Situated near the village Anumadakuppam.
Sattamai hill.	314	12° 33′ 38″	79° 54′ 13″	N.N.E. of Karunguli hill.
Perumberkandigal—Acharapakkam range.	659	12° 23′ 0″	79° 47′ 23″	The highest point is nearer to and accessible from Perumberkandigal.
Avirmedu hill.	490	12° 27′ 13″	79° 54′ 45″	4 miles S.E. of Madurantakam.

Name of Mountain or Hill.	Height of the highest point in ft.	Position of Highest point. Latitude.	Longitude.	
Muppantal—Tonnadumalai.	451	12° 23′ 40″	79° 54′ 10″	*These form the Mup*-pantal-Tonnadu-Mangill Kuchi -- thatharmalai group including the hillocks near Peruvali, Porur, Melvasali and Kokkakrantangal.
Kuchi-thathar-malai.	320	12° 21′ 30″	79° 53′ 18″	
Mangill malai.	401	12° 22′ 30″	79° 52′ 55″	
Edamich hill.	652	12° 41′ 30″	79° 51′ 53″	This includes several detached hills, the highest of which is near the village Edamich; it includes the hillocks near Kunnavakkam, Baleswaram, Mambudur, Palaveri and Arunkunnam.
Sittalapakkam hills.	450	12° 43′ 47″	79° 51′ 6″	Sittalapakkam hills include those situated west of Edamich extending to the banks of the Palar.
Oratti hill.	528	12° 22′ 37″	79° 40′ 42″	
Malaivaiyavur hill.	340	12° 35′ 43″	79° 53′ 35″	

To bring out the orogenic direction of the region, I propose arranging the hills to be found in the Saidapet, Sriperumbudur, Chingleput, Conjeeveram and Madurantakam taluks in the following manner proceeding from the west to the east :—

Kunnavakkam hill.	Malai pattu hill.	Erumaiyur hill.	St. Thomas Mount.	Nanmangalam hill.	Sittalapakkam hill.	Vembedu malai.
Sittalapakkam hill (including hills N.E. of it).	Edamich hill.	Appur hill.	Pallavaram hill.	Unamanjeri hill.	Kalway hill.	Mailai (or Kattur hill).
	Oratti hill.	Venpakkam hill.	Mullumalai. Pachaimalai.	Kumili hill.	Agaram hill.	Edakunram.
		Venkatapuram hill.	Tambaram hill.	Angur hill	Ramamalai.	Tirukkalikkunram.
		Malaivaiyavur hill.	Vandalur hill.	Vallam hill.	Santhakuppam hill.	Muppantal malai.
			Guduvancheri hill.	Alappakkam hill.	Nemmali hill.	Mangili malai.
			Settipunyam hill.	Tirumani hill.	Alagusamudram hill.	Kuchi malai.
			Kandalur hill.	Acharapakkam hill.	Avirmedu hill.	Thathar malai.
			Hanumantaputter hill. Sattamai hill. Karunguli hill.			

RIVERS OF THE DISTRICT

The rivers of the region are all non-perennial ones very capricious in their nature, as they depend upon the N. E. monsoon and occasional cyclonic downpours, the latter especially occurring during the early part of May, or October. Of the rainfall about 2/3 or about 30 inches fall during the N. E. monsoon in the months of September, October, November and December and the remaining 1/3 is received either during the S.W. monsoon or during cyclones, to which the coastal region for about 100 miles north and south of Madras is peculiarly liable. The average rainfall of the district is about 45 inches, though very occasionally more than twice that amount has been recorded locally, and even upto 20·75 inches within an interval of 24 hours; on the other hand in some years as low a rainfall as about 20 inches have also been recorded. This clearly indicates the extreme undependable and capricious nature of the rivers for irrigation purposes, frequently causing disastrous floods and at other times deplorable famines.

The Palar.

The Palar is the principal river in the district. It rises to the south-west of Chintamani town in the Kolar district, and after flowing through the North Arcot district, and receiving in its course the Poiney, from the north about 6 miles of Arcot town, enters the district some ten miles west of Conjeevaram. About twelve miles east of the latter place and three miles E.S.E. of Walajabad, it is joined by the Cheyyar at Tirumakkudal, and reaches the sea after a further course of about 30 miles at a place about 4 miles south of Sadras and about forty miles south of Madras. The valley of the river has been cut from its source to as far as Vishar, about 6 miles west of Conjeevaram, in the highly folded Archæan gneisses of the Peninsula, and east of Vishar as far as Walajabad in the Older Alluvium (the Conjeevaram Gravels of R. Bruce Foote) most probably resting on still older jurassic beds. From Walajabad upto about six or seven miles from the coast the valley is again cut in gneissic and granitic rocks, while east of Nerumbur till its mouth it runs through the coastal alluvium mostly consisting of sands and grits with some intercalated clay beds. Hence, the whole course of the river from below Arcot to its mouth is covered by the recent river alluvium of clays, sands, gravels and pebbles, made up of materials eroded by the river in its course through the gneissic rocks above Arcot.

The amount of water in the Palar year by year is by no means constant: frequently, it is not in floods for several years consecutively: but in rare years it continues to be in flood for six months in a year at one stretch.[10] As the gradient of the river after its debouchure to the coastal slope to the sea is rather steep, the current also is very rapid during the floods, thus making it both difficult and dangerous to be crossed. Such floods are caused by sudden and torrential downpours of rain during the N.E. monsoon or during cyclones, and the successive breaching of tanks supplied by it higher up in its course.[10a]

The Korttalaiyar

The Korttalaiyar starts as the Kaveripak-nadi in the surplus weir or Kalingula of the Kaveripak tank about eight miles north-east of Arcot, and before it enters the district receives two torrential tributaries the Mahindravadi or Kallar and the Tappur. It enters the district at about a mile east of Manuru railway station between the 32nd and the 33rd mile on the Madras-Arkonam broad gauge, and flows through the Tiruvallur and the Ponneri taluks. At about 2 miles E.N.E. of Takkolam, it is crossed by an anicut, the Kesavaram Anicut, about 18 feet in height above the river bed, which diverts a portion of its waters to the Place's or the Old Bungaru channel Then it makes an abrupt turn to N.N.E. from a roughly easterly direction and runs on to Krishnapuram, where it is joined by the Nagari river, which has already become fairly important on account of the inflow into it of the waters of the Trittany or the Nandi river. Near Pagalmedu, it is again, crossed by an anicut called the Damarappakkam anicut from the village of that name about 25 feet in height from the river bed, which diverts some of its waters to the Cholavaram tank, and to Velliyur for the irrigation facilities of the villages near about. Besides irrigating the surrounding areas, the Cholavaram tank also supplies the Red Hills lake situated south-east of it through a channel connected to the northern side of the latter, which is tapped off from its southern side by another

10. Cf. "It was expected that the channels from the Palar Anicut would ultimately irrigate an area of 78,668 acres, but it irrigates at present not more than 19,204 acres. From the financial point of view also this system has so far proved a miserable failure."—Hon. Mr. Yakub Hasan in his address to the landowners of the Palar river basin on 22 April, 1938.

10a. B. M. Thirunaranan: The Rivers of the Palar Basin, Jour. Mad. Geog. Assocn., Vol. XIII, June 1938, pp. 147-160.

channel to supply the Kilpauk water works, which supply the water facilities of the town of Madras. Near the mouth of the Korttalaiyar at Simapuram, this process is again repeated by a small dam across the river in order to irrigate the villages Minjur, Vallur, etc., and it falls into the Ennore backwaters about seven miles north of Madras,[11] thoroughly spent up after rendering such good service.

The Cheyyar.

The Cheyyar is the impetuous tributary of the Palar, and it rises in the Javadi hills, and enters the district seven miles east of the town Cheyyar in the N. Arcot district at about 1½ miles west of Perunagar. It is very useful for irrigation purposes in that it fills many tanks in its course by channels leading from it; it joins the Palar about three miles east of Walajabad, at Tirumakkudal.

The Arani.

The Arani (or the Araniyanadi, the Wilderness river) begins as the Narayanavaram river from the quartzitic ranges of that name; it enters the district at Koppedu and runs through the Tiruvallur and the Ponneri taluks, and joins the sea near Pulicat. Its utility is in that it fills in its course several tanks, the important of which are the Nagalapuram tank, the tank near Vadamadurai, the tank near Arani and the one near Perumbedu.

The Cooum.

The Cooum (or the Madras river, or the Triplicane river) starts in the Conjeeveram taluk at the surplus weir of the tank of that name west of Kilacheri, and is joined by the Place's Canal,

11. Recently, in order to store up a permanent supply of water for the city of Madras even in exceptionally dry years when both the monsoons more or less fail locally, it has been proposed to construct a dam of about 50′ high between the Rangapuram and the Pundi hillocks, which are about 90′ in height above the surrounding region. This scheme will convert an area of about 11·85 square miles into a reservoir submerging several villages completely as Pundi, Rangapuram, Arumbakkam, Kattanur, and parts of Thirupper; Ramanjeri, Pandur, Kannankaranai, Melagaram, Kolandalur, Thiruvalanbudur and Kannammapettai. The capacity is estimated to be about 4,400 million cubic feet and the reservoir will be roughly four miles N.E. to S.W. with a maximum breadth of about 5 miles, and hence will not only extend as far as the junction of the Nagari and the Korttalaiyar rivers, but will also stretch for about three miles into the present valley of the Nagari as far as Ramanjeri.

(or the Old Bungaru Channel) and runs through the Tiruvallur, the Sriperumbudur, and the Saidapet taluks and the very heart of the City of Madras dividing it roughly into two halves, the northern and the southern; it joins the sea at Madras, after forming a small 'Island', near the Madras University buiildings. Considering its length and size, it is a very important river for irrigation. It irrigates a large number of villages all along its course in the three taluks mentioned above, the more important being Sattarai, Kadambattur, Pinjivakkam, Ariyattur, Kuppam, etc., in the Tiruvallur taluk; Vayalanallur, Nemam, Kuttambakkam, Padur, etc., in the Sriperumbudur taluk and Ayanambakkam and other villages in the Saidapet taluk. A small anicut has been thrown across it at about a mile N.E. of Korattur and its water diverted through the New Bungaru channel to the large Chembarambakam tank, which irrigates a large fertile patch of land including Poonamalle, and Mangadu. At Sittukkadu about 5½ miles N.E. of Poonamalle, it appreciably decreases in width; this is remarkable in that the place appears to mark, in the course of the river, the transition from the river alluvium to that of the coastal estuarine, the latter chiefly consisting of clays.

The Adyar.

The Adyar (or the Saidapet river) has its origin as a small stream in the hill south of Guduvancheri, and is joined by two similar streams, one draining the low ground between Orattur and Arambakkam and the other the region between Vellarai, Sriperumbudur and Irungattukottai including the surplus water of the Sriperumbudur and the Chembarambakkam tanks. But it does not attain any respectable size till it reaches the coastal alluvium half a mile west of the village Anakaputtur. As the level of the water in the stream is usually very low, it is not of much value for irrigation purposes; but, its water is used largely for washing clothes by the dhobies of Madras, at or near the town Saidapet. At its mouth, it widens greatly forming a fresh water lagoon surrounding the Quibble Island, and giving rise to a beautiful scenery ideally suitable for excursions and picnics near Madras.

The Kiliyar.

The Kiliyar Ar originates as the Sukanadi in the high ground and hills near the town of Wandiwash, and is joined by a similar stream a mile north-east of the village Padiri called the Salavemadu, which drains the region south and west of the village

Salavedu. Then it flows into the Madurantakam tank and continues eastward over the kalingula, and joins the Palar a mile east of the village Isur, and about eleven miles from the mouth of the Palar.

The Ongur.

The Ongur river, which forms for some distance the southern boundary of the district, begins as the Nedungal Ar draining the area north-west of the village Nedungal. and is supplemented by the inflow into it of two similar streams, one draining the northern and the other the southern portions of the village Olakkur about a mile north of the village Ongur. Near its mouth its bed becomes very narrowed, and the river here goes by the name of the Athangarai Ar; it embouches into the back-water of Yedyanthittukaliveli east of Chunampet Village.

The Kandigayeru.

North of the Satyavedu hills, there is a torrential stream called the Kandigayeru (or the Yellappanayudupet), which rises in the Nagalapuram ranges as the Sodamakona. It irrigates a few flourishing villages along its valley, as Birakuppam, Pravalavaraneswarapuram, Pandur, Arudur, Varadayyapalaiyam and Kalattur. It falls into the Kalangi river about 1½ miles south of the town of Sulurpet, a fairly important town in the Madras-Gudur broad gauge section.

GEOLOGY OF THE REGION.[12]

The following sequence of geological formations is to be met with in the area under review, and they will be considered in order from the oldest to the youngest:—

12. It is assumed that the reader is familiar with the beautiful popular account regarding "The Geographical Evolution of Madras and its Environs" by the late Prof. H. Narayana Rao published in Vol. I of the Jour. Mad. Geog. Assocn., 1926-'27, pp. 59-68.

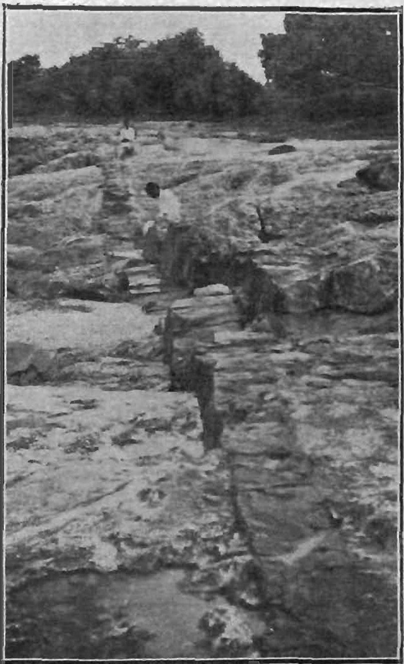
Geological formations.	*Age.*	
Aeolian formations Alluvial formations, fluviatile estuarine and marine.	Recent	Aryan Era.
Detrital or Recemented Laterite Conjeeveram Gravel and Older Alluvium.	Upper Tertiary (?) & *Pleistocene.*	Aryan Era.
Compact Laterite occurring over the Jurassic beds.	Cretaceous and Tertiary	Aryan Era.
Upper Gondwana formations belonging to the Sriperumbudur and the Satyavedu stages.	Middle and Upper Jurassic.	Aryan Era.
Cuddapah formations belonging to the Nagari stage.	Purana Era.	
Gneisses and the associated Igneous rocks.	Vedic Era.	

GNEISSIC AND OTHER IGNEOUS ROCKS.

The gneissic rocks of the area with the exception of the Charnockites, which have been described rather in detail below, have not been carefully studied and classified. Beyond the fact that they consist of biotite or hornblende gneisses, mostly granitic in composition with an appreciable proportion of felspar nothing more can be inferred at present. The alteration and weathering of these rocks have, no doubt, given rise to the Conjeeveram gravels and the pure porcellanous Sriperumbudur shales of the area. These gneisses have been folded roughly in the N. N. E., to S. S. W., direction not only before the intrusion of the Charnockites series, but also to a less extent immediately after the intrusion of the Charnockites. As a result of these foldings the Charnockites appear to have formed the core of these mountain chains, and the general trend of the folding may hence be inferred by the present arrangement of the hillocks, which represent the root or stock of the original mountain chains.

Subsequently during the submergence and the deposition of the Cuddapahs, and again during the elevation of the deposits, the

area appears to have been again tectonically affected; the various porphyritic dolerite dykes containing porphyritic crystals of hornblende and felspar to be seen in the Nagari and Tiruttani region, probably, are to be associated with the first phenomenon; and the



Dolerite Dyke across the Nagari Valley below Nagari village.

—*Photo by Mr. S. Narayanaswamy.*

Cuddapah rocks are nowhere penetrated by these. Two sets of dykes can be recognised one set running roughly N-S with a variation of about 5° east or west, and the other set N. E. to S. W., though both sets appear to be of the same age. As these project out

of the surface for quite a good height forming bold ridges and crests, they form characteristic topographic features of the country. They have been described as forming "one of the most remarkable displays of trappean injection known in any country."[13]

After the deposition of the Jurassic formation and its elevation, there appears to have been no remarkable structural changes in the region.

The Charnockites.[14]

The various members of the Charnockite series form a closely related group of gneissic rocks, which are found widely distributed in the various parts of South India, and which are distinguishable both in the field and in the laboratory, on account of these possessing some common remarkable, unmistakeable and individualistic characteristics. *These common features are so expressive, that* the different types in the series itself may be mistaken one for the other, *e.g.*, the acid member for the basic one.

The leading features in hand specimens of the various members are the medium grained texture, the bluish gray to dark green colour, the subconchoidal fracture, and the absolutely fresh condition of the common unaltered specimens. *Quartz* when present is invariably blue in colour; the *felspars* present a similar blue or blue-gray colour, and they may be mistaken for quartz but for their cleavage, lustre and fracture. These two minerals, (which are usually white in colour in acid members of normal igneous rocks) and the black minerals as *pyroxenes*, *amphiboles* and *iron ores*, which are equally abundant, make the acid as well as the basic members look similar in hand specimens.

Microscopic characters are equally distinctive. The constant structure is the granulitic or even grained character of the constituents, and the constant mineral is *rhombic pyroxene*, which is generally pleochroic approaching *hypersthene*, or in some cases *amblystegite* in composition.

13. R. B. Foote, North Arcot District Manual, 1895, p. 14.

14. Sir T. H. Holland; Mem. G.S.I., Vol. XXVIII, pt. 2. The series was so named by Sir Thomas Holland after Job Charnock, the founder of Calcutta, who died in 1693 and whose tombstone, discovered about the time the series was being studied, was found to be made out of this rock brought from St. Thomas Mount, near Madras.

Nearly all the varieties exhibit a linear arrangement of minerals, but the absence of crushing shows that this arrangement of crystals with their longer axes perpendicular to the direction of pressure must have taken place before the complete consolidation of the magma. Those varieties, which show a clearly defined gneissose structure, invariably contain pink garnets.

The Charnockite group of rocks occur in four sharply marked off divisions :—

(1) The Acid division or Charnockite, which is a *hyperstkene granite* having a constant specific gravity of 2·67 and silica percentage of about 75. It is typically seen in the central portion of the triangular hill rising to about 250 feet above the mean sea level, south-west of the powder magazine at St. Thomas Mount, a military station eight miles south of Madras. It is cut by coarse quartz-felspar or charnockite pegmatite *contemporaneous* veins. The black minerals, as ferro-magnesian silicates and the iron ores, which are found in mere traces, exhibit a linear arrangement parallel to the general foliation of the country N. N. E. to S. S. W. This rude foliation appears to have taken place before the complete consolidation of the magma. The main mass of St. Thomas Mount is made up of *norite* with plenty of acid veins.

The Charnockite also occurs associated with *Norite* and *Leptynite*, the latter occurring in the junction of the two, near Pallavaram, eleven miles south of Madras; east of the railway station the leptynite forms small rocky ridges and the lower portion or gully is occupied by norite; west of the railway station a rather rare charnockite containing biotite and garnet is found; and the small hill near the village of Pammal two miles west of Pallavaram is composed principally of *hornblende-augite norite* with numerous acid veins much coarser in texture than the norite; a *pyroxenite* dyke 3 feet to 5 feet in thickness is also found to cut the norite branching in a rather ramifying manner. A similar dyke 9 inches in thickness is seen to run N.N.E. to S.S.W. in a hill north-east of Pallavaram railway station. Still further south, about 35 miles from Madras the charnockite forms the crystalline rocks of Mahabalipuram or the Seven Pagodas out of which the various caves and temples are carved. Here, the rock chiefly consists of blue quartz and micro-perthitic felspar, and the latter has been decomposed to fairly great depths when compared to the freshness of the rocks making up the other outcrops. This is, probably, due to the fact that being near the coast the region might have been submerged below the sea during the Jurassic times, when the marine coastal beds on the Coromandel coast were deposited.

(2) The Intermediate division is by far the most abundant, and is characterized by an apparently composite structure, all the minerals of the series being frequently found in the same hand-specimen with a tendency for the coloured minerals to gather into groups. The average specific gravity is 2·77 and the silica percentage is about 64. Acid contemporaneous veins and basic fine grained *schlieren* or *segregation products* are also common. Shevaroy Hills form the typical exposure. A good number of outcrops of crystalline rocks in the Chingleput and the South Arcot districts, as those in Tindivanam, in Nemmali, in Perumbakkam, in Kunam etc., consist of the intermediate variety.

(3) The Basic division or *Charnockite Norite* is composed of *hypersthene, augite, plagioclase and iron ores, often with hornblende*. The type areas are the flanks of the hill mentioned under (1). Specific gravity averages 3·03, and silica percentage about 50 to 52. The main hill of St. Thomas Mount consists of this variety, which is intruded a great deal by acid veins. This is the variety more frequently used for monumental purposes, tombstones and other ornamental structures in and around Madras: it takes an excellent black polish, which is intensified by coating the polished surface with a very thin film of oil.

(4) The *Ultrabasic* sub-group chiefly consists of *pyroxenites*, which are composed of *hypersthene, augite, hornblende and sometimes with olivine, green spinel and magnetite*. Specific gravity is 3·37 and the silica percentage varies between 47 to 50. *Amphiblisation* of the pyroxenes is common. These frequently occur as dykes in the other charnockite members running parallel to the general foliation and rarely across in a ramifying manner. A pyroxenite dyke 3 feet to 5 feet in thickness may be seen cutting the norite in a ramifying manner in the small hill near Pammal, a village two miles west of Pallavaram. A similar dyke about 9 inches in thickness may also be seen running N. N. E. to S. S. W. in a hill north-east of Pallavaram railway station.

Garnetiferous Leptynite.

Near the margin of Charnockite, where it comes into contact with norite, there occurs a friable cream coloured rock with plenty of pink garnets, which take the place of the usual hypersthene in charnockites. Both in the field and in the laboratory examinations, the rock exhibits signs of dynamo- or pressure-meta-morphism ; the weaker minerals have been crushed and are surrounded by granulated selvages: quartz shows very strongly marked undulose extinction, but preserves the bluish gray colour.

The chief minerals found in the Charnockite series are *blue, gray or greenish quartz with acicular inclusions of rutile,*[15] *microcline and microperthite in acid types. labradorite, andesine in basic types, pale green feebly pleochroic hornblende. biotite, graphite. zircon, apatite, and iron ores as magnetite. titanoferrite, pyrite and pyrrhotite.* The iron ores are usually found in large quantities and *sphene is characteristically absent.*

THE CUDDAPAH FORMATION

The quartzites, which go to make up the Nagari peak, near the village of that name, though the peak itself is outside the limits of the district, is worth mentioning: the peak. or the 'Nagari Nose' as it is called, is so high (2814 feet) that it can be seen from great distances. It was a very valuable land-mark to the English sea-men in the early days of the East India Company, the peak being visible even when the ship was 50 miles away.[16] The quartzites belong to the lower division viz., the Nagari stage of the Cheyair series,[17] which is a division of the Cuddapah group of rocks and forms the southernmost outlier of the Cuddapahs[18] A little further north. the rocks are also seen near Narayanavaram and near Kalahasti.

15. The colour appears to be due to acicular inclusions of rutile. Vide: N. Jayaraman—Pro. Ind. Acad. Science, Vol. IX, No. 3, March, 1939.

16. L. W. Lyde—*The Continent of Asia, 1933, p. 470.*

17. W. King—On the Kadapah & Karnul formations in the Madras Presidency—G. S. I., Vol. VIII, p. 126. *The* Kadapah formation according to W. King is divisible into the following divisions:—

Kistna group 2,000 feet.	..	Sreeshalum quartzites Kolumnullah slates Irlaconda quartzites
Nallamullay group 3,400 feet.	..	Cumbum slates. Byrenconda quartzites.
Cheyair group 10,500 feet.	..	*Poolumpett slates* Naggery quartzites
Paupugnee group 4,500 feet.	..	Vaimpully slates Goolcheroo quartzites.

18. Some detached gigantic blocks of quartzite are also to be seen apparently below the Jurassic beds of the Allikkuli region in the western portion; these represent the southern-most extension of the Cuddappahs at the present day; but the occurrence of quartzitic boulders in the Allikkuli and the Satyavedu areas indicate an extension of the quartzite beds to these places during the Jurassic times.

while the main outcrop begins at Tripetty and the extreme south end of the Vellakonda ranges and runs on to the type area, Cuddapah, and to a great distance further north to the banks of the Krishna river. The southern and eastern approaches of the ranges are remarkably magnificent and highly picturesque, forming grand scarped white cliffs resembling ramparts. The rocks are mostly quartzites, sandstones, grits and conglomerates with occasional thin bands of slates or slaty shales; the conglomerates consist of pebbles of gneiss, quartz and banded jaspers. The prevalent colours are pale gray, gray and drab, becoming on weathering, buff, or pale brown.

East of the outcrops mentioned above, another important outlier of the Nagari quartzites is to be seen, in the form of an elongated crescent facing westward, the northern part of which forms the Kambakkam Drug and the southern portion the Nagalapuram ranges. As already pointed, these ranges form the highest mountains to be met with in the district itself, the Nagalapuram peak being 2,891 feet. As the Kambakkam durgam itself is 2539 feet, the climate in most months of the year is very pleasant, and the region is probably the nearest rather thickly forested area to Madras. The quartzites rest uncomformably over the gneiss and frequently also the eastern margin of these is much crushed by lateral thrusts proceeding from the east, so that the dip is not constant. Three sub-stages may be recognised in the area: the bottom-most consists of thick and massive quartzites, sand-stones and conglomerates, more cleaved and jointed than the overlying ones. The thickness may be about 400—500 feet. (2) This is overlaid by about 700 feet of banded sandstones and flags, which are in turn followed by (3) which is made up of a thick bed of quartzites including coarse sandstones and conglomerates, which are more ripple marked,[19] but not so coarsely conglomeratic as the lowermost band. The middle band occasionally contains talcose flags, which are occasionally strongly seamed with white quartz. The peak of Nagari Nose consists of the lower most band, and in Ramagiri Malai only the middle division is to be seen; in the other outcrops more or less all the three substages may be recognised.

19. This reveals that the eastern coast of the Peninsula was determined as early as the Cuddapah times as compared to the west coast which is agreed to have been fixed in the late Cretaceous or in early Tertiary times. Vide also Prof. H. Narayana Rao, Jour. Mad. Geog. Assocn., Vol. I, 1926-'27, p. 62.

THE JURASSIC FORMATIONS

General Distribution.

All the outcrops of the Jurassic beds belonging to the Sriperumbudur and the Satyavedu stages north of the Palar river are found distributed within an area of about 1,000 square miles. The boundary of this extensive patch starting from about four miles west of Conjeeveram at Vishar extends northward along the western base of Allikkuli and the Satyavedu hills; following the foot of the latter hills in the north, it runs eastward along the lateritic outcrops to be found north of the Arani river and following the eastern boundary of these it continues southward to the Red Hills: from there it turns south-westwards and stretches across the Poonamallee alluvium to Palanjur on the north bank of the Chembarambakam tank, and from there roughly southward to the Appur hills: then it continues westwards to Conjeevaram and a little beyond to Vishar. Besides this wide basin, several detached much smaller outcrops may be recognised south of the Palar; a very small but interesting one is found near Mamandur and Umaiyapuram and about 25 similar patches, all of them situated in the Arcot taluk south-west of Conjeeveram town; three more fairly extensive areas occur further south in the district itself. The northernmost of these is seen between Uttaramerur and Nelvay, the middle one around Padiri and the southernmost around Velangadu west of the Acharapakkam hills. Further, the Jurassic beds appear to extend eastward below the coastal alluvium as revealed by a boring in Ennore,[20] and we do not know to what distance into the Bay of Bengal. These detached occurrences in rather widely separated areas clearly show a much greater extension of the beds in the geologic past, these outcrops being either the denuded remains or the inliers covered up by later deposits consisting chiefly of laterites, of this extensive formation, probably deposited in one unbroken stretch along the continental slope of the east coast of the Peninsula. As one could infer from their occurrence in the Allikkuli and the Satyavedu ranges, the depth must be decidedly appreciable; even in the shaly zone at Kilacheri a boring penetrating to a depth of 430 feet did not reach the basement gneiss.[21]

20. Mem. G.S.I., Vol. XXXII, pt. I. 1901, p. 51.
21. *Ibid.*, p. 78.

Five groups.

From their superficial distribution, the outcrops may be considered in five groups: — (1) the Satyavedu region; (2) the Allikkuli region: (3) the Palayanuru region;[22] (4) the Sriperumbudur region and (5) the outcrops south of the Palar. The exact relationship of the formations of these five regions could not be made out definitely, due to lack of section showing them in contact; the first area is almost wholly conglomeratic; the second conglomeratic with shaly beds below them; the third, sandy and shaly; the fourth mostly shaly and the last mostly sandy.

Stratigraphic Divisions and Age.

Stratigraphically, the Jurassic beds may be roughly divided into two divisions (1) the lower stage mainly consisting of shale the Sriperumbudur stage and (2) the upper stage made up of conglomerates and sandstones—the Satyavedu stage.[23]

Age of the Sriperumbudur Stage.[24]

The peculiar and characteristic plant fossils (*Pecopteris reversa. Taxites planus, Gingko crassipes*) occurring in this stage are also to be found in the Raghavapuram stage; and among the ammonites the same form occurs in both the localities. Taken as a whole the plants represent a *mixed flora* containing types belonging to the Rajmahal and the Jabalpur series, but the peculiar forms of the Rajmahal series (e.g. *Macrotœniopteris, Cycadites, and large Pterophyllum*) are absent. Hence it is assigned a slightly higher position than the Rajmahal series. The other outcrops which appear to belong to the same age are the Athgarh stage near Cuttack, the

22. This corresponds to the Pyanoor division of R. B. Foote, for the Pyanoor village of the Indian Atlas sheet 78 appears to be none other than the Palayanuru village of the One Inch Survey of India sheet.

23. R. Bruce Foote, who recognised the two divisions called them *groups* (Mem. G.S.I., Vol. X, 1873, p. 64; Rec. G.S.I., Vol. III; 1870; pp. 14 & 15). These were afterwards modified into *series* by Sir Thomas Holland and G. H. Tipper (Mem. G.S.I., Vol. XLIII, pt. I, 1913. p. 107; Vol. LI; 1928; p. 155). They were, however, still later designated *stages* by C. S. Fox in 1931 (Mem. G.S.I., Vol. LVIII, 1931. p. 210 & 214).

24. O. Feistmantel, Palaeontologia Indica Series, II, Vol. I, pt. 4; 1879; p. 2.

C. S. Fox, The Gondwana system and related formations, Memoirs of the Geological Survey of India, Vol. LVIII, 1931, p. 214.

Vemavaram stage in the Guntur district, and the Utatur stage in the Trichinopoly district.

Age of the Satyavedu Stage.[25]

No definite age can be assigned to the stage as the fossils are too poorly preserved and indeterminate except a Dictyozamites but as it lies over the Sriperumbudur stage it must be younger than the latter ; hence it is generally considered Upper Jurassic.

25. O. Feistmantel, ibid., p. 3.
C. S. Fox, ibid., p. 214.

Various Outcrops in the Madras Presidency.

Indian Age.	West Godavari and Kistna Dts.	Guntur Dt.	Chingleput Dt.	Trichinopoly Dt.	European Age.		
Jabalpur stage.	Tripetty[26] stage.	Pavalur[27] stage.	Satyavedu stage.	Sandstone stage.	Portlandian Kimmeridgian	Upper Oolite	Upper Jurassic
	Raghavapuram[28] stage.	Vemavaram[29] stage.	Sriperumbudur stage.	Utatur[30] stage.	Lusitanian Oxfordian Callovian	Middle Oolite	
					Bathonian. Bajocian.	Lower Oolite	Middle Jurassic
Kota Stage.		Budavada[27] stage.					
Rajmahal Stage.	Golapalle[31] stage.				Aalian Toarcian Charmouthian Sinemurian Hettangian	Lias	Lower Jurassic.

26. Tripetty or Chinna Tripetty is situated about 24 miles N.E. of Ellore.
27. Pavalur and Budavada are about 12 miles N.W. of Chinna Ganjam.
28. *Raghavapuram is about 29 miles N.E. of Ellore.*
29. Vemavaram is located about 2½ miles S.W. of Chinna Ganjam.
30. Utatur is situated about 20 miles N.N.E. of Trichinopoly town.
31. Golapalle is 12 miles west of Ellore.

Fossils.

The following fossils have been got from the Sriperumbudur stage, chiefly from the N. E. portion of the basin. As the plants are more numerous and more important in fixing the age they are mentioned first :[32]—

FERNLIKE FORMS—(FILICES AND PTERIDOSPERMÆ.)

Thinnfeldia sp.
Thinnfeldia sp. (*Dichopteris*).
Alethopteris whitbyensis.
Alethopteris indica.
Pecopteris reversa.
Angiopteridium spathulatum
Angiopteridium McClellandi.

CYCADS—(CYCADEACEÆ)

Anomozamites lindleyanus.
Pterophyllum footeanum.
Pterophyllum sp.
Otozamites abbreviatus.
Otozamites rarinervis.
Otozamites bunburyanus
Ptilophyllum acutifolium.
Ptilophyllum cutchense.
Ptilophyllum cutchense, var., *minimum.*
Dictyozamites indicus.

CONIFERS—(CONIFERÆ).

Palissya conferta.
Araucarites cutchensis.
Araucarites macropterus.
Pachyphyllum peregrinum.
Brachyphyllum sp.
Echinostrobus rajmahalensis.
Echinostrobus rhombicus.

32. O. Feistmantel—Pal. Indica Series II, Vol. I, pt. 4, 1879, p. 3.
C. S. Fox—The Gondwana system and related formations, Mem. G.S.I., Vol. LVIII, 1931, p. 214.
F. Stoliczka—Rec. G. S. I., Vol. I, pt. 3, 1868, p. 59.

Taxites planus.
Gingko sp.
Gingko crassipes.

Of the animal remains a few small indistinctly preserved Ammonites belonging to the Dentate group have been got, one of these is the same as that found in the Raghavapuram and Budavada stages; in addition the following also were present:—

Lamellibranchia:—*Leda, Yoldia, Tellina, Psammobia, Lima, Pecten.*

Brachiopoda:—*Rhynchonella.*

All the Lamellibranchia are remarkably thin shelled forms, the allied ones of which are to be found at present in the sandy bottom of the sea at depths varying from 8-10 fathoms. Several exhibit a resemblance to specimens from the cretaceous rocks of Trichinopoly, but none appear to be superficially identical.

The plant fossils occurring in the Satyavedu stage are too ill preserved and indeterminate except a Dictyozamites.[33]

DESCRIPTION OF THE AREAS

(1) *The Satyavedu Region.*

The region, though now limited to the Satyavedu hills must have been once continuous with the Allikkuli hills across the valley of the Naranavaram or Arani river. Practically the whole hill consists of very coarse conglomerates, the pebbles varying in size from one's fist to about two feet cemented together by a hard dark purplish, chocolate brown ferruginous calcareous or siliceous cement. The whole area is so covered up by the weathered conglomerates that it is impossible to know the real sequence of beds except very locally. Thus, the weathering of the Satyavedu and the Allikkuli hills has given rise to the pebbly and gravelly laterite covering the greater part of the lower and eastern coastal alluvial plain as far as the Red hills. A fairly good section is to be seen north of Surutapalli[34] in the narrow valleys of the S. E. portion of the hills, where three great conglomeratic beds crop out with inter-

33. O. Feistmantel—Pal. Indica, Series II, Vol. I, pt. 4, 1877; p. 3.

34. Surutapalli appears to be the same village as Sirgulpilly of Ind. Atlas Sheet 78 and R. B. Foote's description. Sirgulpilly finds no place in the One Inch Sheet.

vening less compact conglomerates. The northern part of the hill is made up of a similar very coarse conglomerate exposed in steep cliffs up to 150 feet along the valleys with intercalated beds of sandstones. The sandstone is quarried at various places for building stones or for making into shallow water-tubs, which are used by the villagers in the feeding of their cattle. Such quarries may be seen at Surutapalli, near Satyavedu and along the road from Satyavedu to Kannavaram. The sandstones which assume various colours as deep red, purplish red, reddish yellow etc. are soft possessing little or no lamination and contain frequently pebbles of quartzite.

Though the general dip is 10°—18° eastward or south-eastward, it is very varying; north-east of Surutapalli it is 10°—12° S.S.E.; about 3½ miles north-east of Tripurantakapuram, the coarse conglomerates, resting on horizontal quartzite beds of the Cuddapah system, show a dip of 5° N.W.; near Satyavedu it is 5°—10° N; and on the western portion 5°—10° W.S.W.

No fossils are usually found either in the sandstones or in the conglomerates; but in the quarries along the road from Satyavedu to Kannavaram and in those about 2 miles S. W. of Satyavedu in the yellow sandstone associated with the reddish brown or purple variety, fragmentary plant remains have been reported.

(2) *The Allikkuli Region.*

This area comprises the Allikkuli hills and the outcrops occurring north of the Nagari and the Korttalaiyar rivers, where both the Satyavedu and the Sriperumbudur stages are represented. The compact conglomerates which, as already pointed out, must have been once continuous with the Satyavedu area, is underlaid by friable sandstone conglomerate; the junction between the conglomerate and the sandstone is impossible to be made out on account of the conglomeratic débris; but it is very probable that the transition occurs in the valley north-west of Hadsanpuram; for, two miles due north of this place are to be seen the westernmost and lowest conglomerate beds which present as one proceeds eastward several escarpments.

The last and probably the thickest of the conglomerate beds is very remarkable in that it forms a deep ravine opening eastward formed by a non-perennial rivulet. The head of the valley is circular and amphitheatre-like with a diameter of about 250 yards; the depth of the ravine with vertical sides may be about 125 feet; the amphitheatre is by no means open and empty, but contains

here and there huge blocks of conglomerate with vertical or steep sides. On the southern side of the amphitheatre is to be seen a large and spacious cave which in ground plan is a shallow crescent,

Sandstone bed intercalated between conglomerate beds in a quarry near Allikkuli.

Eastern portion of the Allikkuli Cave.—Note the roof of the cave sloping in the direction of dip.

Weathering of the Upper Jurassic or the Satyavedu conglomerate in the Allikkuli region.

Caves adjacent to the main Allikkuli Cave.

—*By Mr. B. M. Thirunaranan.*

the chord of the arc measuring about 230 feet, the greatest breadth being about 65 feet. The height of the arch-like entrance, the margin of which is not definite but rounded and steeply sloping

with vertical side of the cliff higher up, may be about 30—40 feet; but the height of the roof of the cave is varying so much so at the farthest end it decreases to 4 or 5 feet ; similarly the floor is not a perfect horizontal plane but gently sloping towards the entrance. The cave is cut entirely in the coarse boulder conglomerate, so that the roof, the sides and the floor consist of very coarse quartzite boulders or pebbles. There is no kind of deposit or encrustation except decomposing bats' dung on the floor and innumerable wasps' nests on the roof. The floor is abundantly strewn with loose large pebbles disintegrated from the conglomerate bed and from the roof trickles down, at several places, small quantities of deliciously cool clear and sweet water, which is collected in small earthen pots by the goat-herds and villagers, who frequent the place evidently for drinking. The floor is gently wet and cool; the air is soothing and pleasantly moist and the inner portion of the cave, as the inner walls and floor, is overgrown by ferns; in short, to take rest there on a hot summer day is marvellously pleasant and exhilarating. As a place suited for excursions and picnics, few places near Madras could be compared with it. Besides, the place is reached not with much difficulty from Gunipalaiyam, a village situated on the eastern side of the ranges along a foot-path in the mostly dry rivulet mentioned earlier. The distance is slightly over three miles.

Just away from the entrance of the cave at the head of the valley, the small rivulet forms a small waterfall, falling down the straight precipice. When one climbs up to the top of the precipice through narrow passages overgrown with thick and luxuriant vegetation, it will be seen that two small rivulets converge to the waterfall, draining two or three shallow valleys. There is not the least doubt that in the rainy season the amount of water in the waterfall and in the rivulet must be fairly abundant, and hence, must scour a good portion of the cave floor.

The formation of the cave is a problem. Foote felt that the river was too small a factor to carve this piece of magnificent geologic architecture and he thought that during the formation of laterite (which was according to him marine in origin) in the coastal plain, the sea must have entered the land and not only eroded the valley but also scooped the cave by marine and surf action.

The following facts appear to the author of the paper as relevant in explaining the origin of the cave :—

1. There is absolutely no evidence of any marine fossils in any part of the valley; nor is there any evidence of an existence of a beach in front of the cave or elsewhere in the valley.

2 Conglomerate is a rock which offers very little resistance to weathering agencies; it can be disintegrated merely by solution or weathering of the cement between the pebbles and boulders. So, it is extremely unlikely that the whole formation would have withstood marine action, had the sea extended so far inland. It was already pointed out that the amphitheatre was not open and empty, but strewn with huge cliffs of conglomerate here and there. These could not have withstood marine action.[35]

3. It has been pointed out that huge blocks or precipices of boulder conglomerate 70 or 80 feet high with vertical sides may be seen both in the Satyavedu and the Allikkuli hills; if the formation of all these could be explained as due to weathering and river action it appears also possible that the amphitheatre could have been formed in the same manner by the same agency. Indeed, one could see in the vertical sides of the precipices at the head of the valley near the water-fall several narrow vertical crevices extending from the top to the very bottom, widening at intervals and leading into dark huge caverns. Roots of some trees situated at the top of the cliffs have sunk in their roots along these crevices to the very bottom of the valley; hence, it is likely that plants also to a subordinate extent, might have helped in the widening of cracks and crevices.

It was also stated above that just beyond the mouth of the cave there was a small water-fall formed by two rivulets joining together at the top of the precipice and that during the north-east monsoon the volume of water must be so appreciable as to scour a portion of the floor of the cave. Hence, it appears very likely that the stream must be considered as responsible for carving not only the whole valley, but also must have helped in the formation of the cave: the gentle slope of the cave-floor to that of the valley further favours this view. Besides, we do not know at present definitely the climatic change in this region during the Pleistocene

35. For this reason the author is indebted to Prof. C. K. Krishnaswami Pillai who also favoured the solution and erosive origin of underground and river water in his presidential remarks, when the author expressed his views at a meeting of the Mad. Geog. Association.

and late Tertiary times. Those workers, who have bestowed some attention on the Pleistocene period of South India, undoubtedly feel that at least two moist or humid periods may be recognised. when the climate must have been much more moist than at present. Thus, it appears that the rivulet must be considered a decidedly potent factor in the formation of the valley and the cave.[36]

4. Those who have visited the cave even in the summer, would have noticed the moist environment of not only the cave from the roof of which, there was a continuous dripping of deliciously cool clear, and sweet water, but also of the shallow valleys above the precipice ; even the narrow passage leading to the top of the cliffs was thickly overgrown with luxuriant vegetation with broad leaves. This clearly indicates that underground water is rather plentiful. The percolating water in the quartzite boulder conglomerate must necessarily do so through the cementing material and in so doing would easily loosen the large round smooth pebbles ; this partly explains the occurrence of pebbles all over the area in such abundance. The villagers also testify to the fact that sometimes pebbles fall down from the roof of the cave and innumerable impressions of such fallen pebbles singly or in masses, may be seen in the roof; the floor also is quite completely covered over with pebbles and boulders.

As the percolating water will find it easier to work along the dip slope of the bedding planes, it will be observed that the roof of the cave also over large portions follows the dip of the beds ; the dip is roughly eastward and though the bedding planes are not well marked, on account of the coarseness of the boulders, yet they could be easily recognised. Higher up on the escarpment side of the hill in two or three such hollows, cool clear water stagnates in which plenty of algae, of which the easily recognisable is Chara, is to be noticed.

5. It was described above, that the margin of the arch-like entrance of the cave is not definite, but that the roof of the cave steeply slopes to the vertical side of the cliff. In the case of marine and surf action there will be no appreciable erosion above the reach of the waves in storms or in high tides and hence this parti-

36. Vide F. J. Richards, L. A. Cammiade and M. C. Burkitt—Geol. Mag., Vol. LXIX, pp. 195-205, 1932.

V. D. Krishnaswami, Jour. Mad. Geog. Assocn., Vol. XIII, pp. 58-90, 1938.

cular feature observed cannot be explained. The steep inward slope appears to be due to the dissolving and weathering action of rain on the sides exposed during the monsoon times; it was pointed out that the cave faces northward and that the trend of the valley is roughly E. to W. This is not the only cave to be seen in the area though this is by far the largest; several small narrow caves much less in breadth could be seen, one in the valley itself further down at approximately the same level and two or three in the lower conglomerate beds above the water-fall.

6. The last factor. viz. the occurrence of caves at all heights clearly indicates a non-marine cause, as in the latter case all will be situated at the same level, namely, within the zone of marine or wave action.

As the result of the enormous quantity of conglomerate débris the real sequence of beds is very difficult to be made out. In the cliffs opposite the cave two lenticular inaccessible patches of sandstone may be seen intercalated with the coarse conglomerate; about two miles north of the Forest Rest House at Allikkuli village, a quarry has been opened out for the quarrying of sandstone which is fine grained and compact with purple or brown wavy bands and resembling in every respect the Satyavedu sandstone. There are practically no good sections revealing the relationship of the conglomerate and sandstone bed with the Sriperumbudur shales and that of the latter with the gneisses or the Cuddapahs. (1) In the off-flow channel bund of the Allikuli village tank are exposed beds of soft clayey grit mottled white and brown underlaid by moderately coarse bed of uncompacted quartzite shingle conglomerate. (2) On the west side of the Allikkuli hills one and half miles north-east of Kaliyambakkam in a rain-gully about 25 feet in depth are exposed large conglomerates of quartzite and granite boulders with a clayey matrix similar to those underlying the Sriperumbudur beds. (3) Immediately east of Surikapuram also west of the ranges a micaceous schist is seen in contact with the Sriperumbudur stage, the former dipping at very high angles towards north-west, and intruded by trap dykes. (4) What appear to be huge blocks of the gray and white Cuddapahs partly disintegrated before the deposition of the Jurassic beds are to be seen between Illaturu and Kosalnagaram;[37] the quartzite blocks are seen to dip north at

37. Naikenpolliam of R. B. Foote's description and Nakinpollium of Indian Atlas sheet 78 coincide with Kosalanagaram of the One Inch sheet. Evidently the name of the village has been changed.

gentle but varying angles and a good number have been tilted at high angles in various directions. (5) Sriperumbudur shales interbedded with sandstones may be seen in a ridge about a mile northwest of Kosalnagaram ; the shales have yielded a good number of fragmentary plant fossils. (6) In the southern extremity of the ranges close to and south of Sriharipuram[38] the gneiss is seen in a deep rain gully very near to the shale outcrop, though not in positive contact with it. (7) The stage which is arenaceous including granitic pebbles is also exposed in three or four places between the Allikkuli ranges and the Nagari river below the laterite, chiefly along the valleys of nullahs, (a) near Sriharipuram (b) along the *large nullah which feeds the Kanjipadi tank (c) along the off-flow* channel of the tank at Mallareddikhandrika (d) in a well section west of Ramanjeri, where some pieces of silicified wood were found (e) and in a well a mile N.N.W. of Tomur where a few unrecognisable vegetable impressions were got. (8) The white or gray shales which appear to overlie the gritty or coarse conglomerate just described are displayed along the several nullahs south-east of the Allikkuli ranges draining into the Korttalaiyar river (a) along the Kallaur or Allikkuli channel (b) along the Attirambakkam nullah and (c) along the Odappai and Meyyur nullahs. These shales are poorly fossiliferous and yielded only a small shell resembling Lucina, a fragment of an *ammonite* and indeterminably obscure plant remains.

Doubtful outliers of the Sriperumbudur stage consisting of whitish shales or buff coloured friable sandstone with small ferruginous concretions occur south of the Korttalaiyar in several places (1) two miles south of Kallikuppam, (2) N. W. of Mittanemeli, (3) south of Puliyur, (4) at Tirumallaivayal and along the railway cutting near Avadi railway station.

The general dip of the coarse conglomerate in the main portion of the Allikkuli ranges is towards E. or S. E. at varying angles between 5°-39° and of the sandstones and shales at Kanjipadi 15°—20° E.S.E. However, east of Kosalnagaram it is 25°—30° N.N.W. and N.W. of it 30° E.N.E.

38. Sriharipuram of the One Inch sheet coincides with Woterpolliam of Sheet, 78, and of R. B. Foote's description; evidently a more dignified name has been given to the same village as it became larger.

(3) *The Palayanuru Region.*

The southern central portion may be called the Palayanuru region, and this includes the various outcrops of the Sriperumbudur and the Satyavedu stages in and around the village Palayanuru found distributed within the angle formed by the junction of the Nagari and the Korttalaiyar rivers. The rocks are chiefly friable sandstones, sandy shales, pebbles and boulder beds belonging to the Sriperumbudur and the Satyavedu stages. As the rocks are covered up by later shingly lateritic conglomerate in several places, the outcrop skirts along the alluvium of the Nagari and the Korttalaiyar valleys. Hence, hardly a good section is available and the nature and distribution of the deposits may be made out only with the help of well-sections. West and south-west of Palayanuru, the belt widens considerably. The general dip is as usual roughly easterly at varying small angles 6°—16°, but local variations are very common.

The best section is to be seen at a low cliff of about 15 feet high near Krishnapuram[39] on the south bank of the Nagari river at its confluence with the Korttalaiyar; the same section on a smaller scale may be seen on the northern bank of the river also; the beds consist of a lower layer of boulder bed, followed by friable gritty sandstone with intercalated sandy clay, and is overlaid by quartzite and lateritic shingle. The friable sandstones in the northern exposure have yielded some plant remains. On account of the boulder bed containing large gneissic boulders, it has been possible to recognise it either occurring alone or associated with sandstone at various places as: (1) in the off-flow channel, north of the great tank at Palayanuru, (2) at the north end of the Uriyur tank consisting of shales and sandstones, (3) in the form of large gneissic boulders associated with gray or drab sandstone on the western edge of the rather elevated ground at Kanjampattu, (4) in the projecting granitic or gneissic boulders in the lateritic formations of the high ground south of the railway line near Harichchandrapuram,[40] close to the Tiruvelangadu railway station; north of the station also the boulder bed is exposed but not so pro-

39. This coincides with Kistnahporam of the Indian Atlas Sheet 78, and appears to correspond to Chittapuram of R. B. Foote's description.

40. The original name of this village appears to have been Catramatoor which is to be found in the Indian Atlas Sheet 78 and also in R. B. Foote's description.

nounced, (5) further westward at Mosur[41] village numerous large rounded blocks of gneiss occur which appear from their position to have been once included in the friable sandstones, (6) in the elevated portion between Mosur and Harichchandrapuram great boulders of gneiss appear on the surface "through the lateritic gravel, some of such size as to suggest the idea of their being surf-worn pinnacles of the underlying granitic rocks". The boulders are chiefly of granite gneiss so large in size as to measure one foot to easily more than five feet in diameter so that many of them have been used by the Prehistoric people to form their "Kurumbar rings"; where the boulders are of quartzite the size is smaller attaining up to one foot in diameter.

But the great extension of the conglomerate mixed with sandstone may be inferred from several well-sections as (1) in those to be seen about a mile south of Krishnapuram (2) in those of the high ground north of the village Kaverirajapuram,[42] (3) in those near Palayanuru, (4) in a well between Palayanuru tank and the temple at Tiruvelangadu village and in other wells slighty westward of it, (5) in those to be found north of Palayanuru and in another north of Toidavaru, all exposing friable or micaceous sandstone; in the former locality it yielded a few brittle fragmentary plant remains and two distorted bivalves, (6) those at Attipattu from which some large boulders have been dug out; (7) in a well S.E. of Mosur exposing a pebbly conglomerate bed of about 12 feet in thickness and (8) in an old ruined well situated about 2½ miles north of Takkolam revealing friable sandstone including quartzite pebbles of about 7-9 feet in thickness.

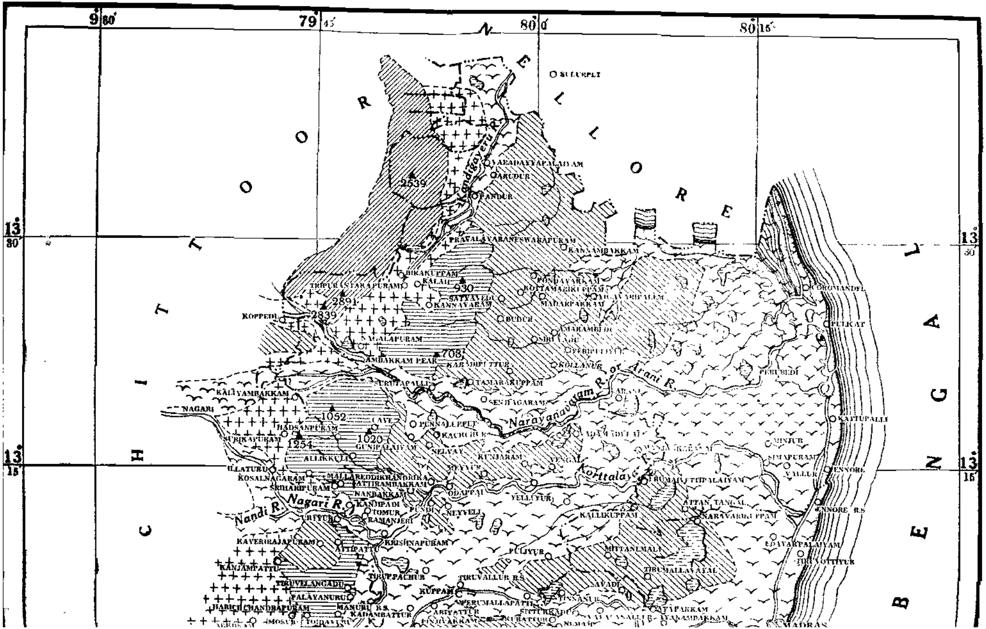
(4) *The Sriperumbudur Region.*

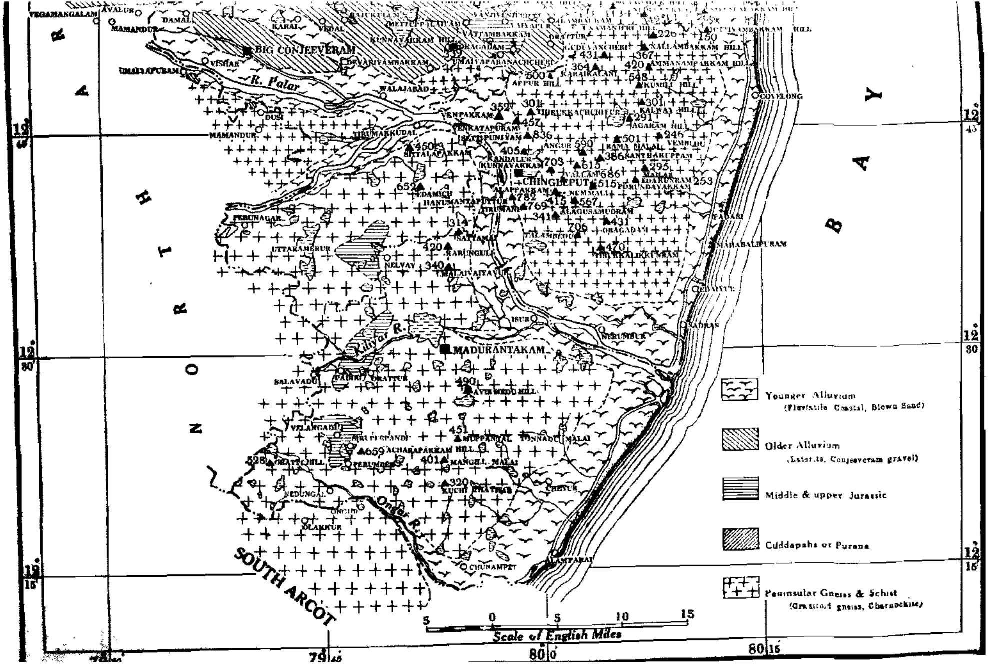
This area includes the Sriperumbudur or Kota stage occurring immediately around the town Sriperumbudur. Two sub-stages seem to be present the exact relationship of which is not known due to lack of sections showing them in contact; the one stage includes the plant shale beds with some underlying gritty sandstones mainly seen in the northern part of the area; and the other stage is seen in the southern portion consisting of grey clays reddish or purplish gritty sandstones and buff coloured arenaceous

41. Mosur is also a railway station on the Madras-Arakonam line situated half a mile west of the village of that name.

42. This appears to be the same as Cavitporam of Indian Atlas Sheet 78, and Cavitpooram or Kavedupooram of R. B. Foote's description.

A GEOLOGICAL MAP OF THE NEIGHBOURHOOD OF MADRAS




BIG CONJEEVERAM
R. Palar
CHINGLEPUT
MADURANTAKAM
Kiliyar R.
Ongur R.
SOUTH ARCOT
NORTH ARCOT
BAY
COVELONG
MAHABALIPURAM
MADRAS
ALAMPARAI
CHUNAMPET
WALAJABAD
UTTARAMERUR
SALAVADU
NEDUNGAL
PERUNAGAR
Younger Alluvium
(Fluviatile Coastal, Blown Sand)
Older Alluvium
(Laterite, Conjeeveram gravel)
Middle & upper Jurassic
Cuddapahs or Purana
Peninsular Gneiss & Schist
(Granitoid gneiss, Charnockite)
Scale of English Miles
5 0 5 10 15
79 45
80 0
80 15
12 45
12 30
12 15

shales very unlike the shales and grits occurring in the northern stage.

The Northern Part.

The best section in the northern part of the area occurs on the flanks of a small hillock, six miles due south of Sriperumbudur town, and half a mile S.W. of Vallakottai village, where a few gritty sandstones and gritty shales occur overlaid by pure white compact porcellanous plant shales followed by lateritic conglomerates with palaeolithic implements. The same beds may also be seen on the banks of the Kambakkal channel running into the Sriperumbudur tank, about half a mile west of the travellers' bungalow at Sriperumbudur. The compact shales contain a good number of fragmentary and beautifully preserved plant fossils, but these are rather difficult to be obtained on account of the too compact nature of the shales. The shales are also seen at various places of which the more prominent occurrences are :—(1) in the bed of the big tank at Sriperumbudur when dry, (2) in the northern end of the same tank near the off-flow channel where it appears to be tilted to a vertical position; (3) in wells south-west of the tank from where several fossils were obtained in the unusually compact shales; (4) in a small shallow gully close to Todukkadu; (5) at Araneri three and a half miles south-west of the traveller's bungalow at Sriperumbudur; and (6) in the south end of the tank at Vallum in a rain gully. In the last two areas the shale beds definitely rest on grits; and near the last outcrop lies a silicified tree trunk one foot in diameter and about a yard long. Thus the whole of the northern half of the Sriperumbudur area appears to be occupied by plant shale beds and the high ground east of Araneri and north of Vallum the outcrop is free from lateritic capping affording good exposures. Further west at Tirumangalam, Kiranallur, Kandur and Tiruppandiyur[43] only the grits are exposed below the lateritic conglomerate as the shales seem to be denuded away.

Further east all along the nullah at Amarambedu from near Sriperumbudur to half a mile west of the Chembarabakam tank,

43. The village Punnoor of Indian Atlas Sheet 78, described by R. B. Foote is not to be seen in the One Inch Sheet but Tiruppandiyur appears to coincide with it; evidently the village has changed its name since R. B. Foote's description.

in the tank bottom at Nallur[44] one and a quarter miles E.S.E. of Amarambedu and in Pudupper in the north-eastern end of the Sriperumbudur area, a clayey shale is seen overlying the porcellanous variety described before separated by a band of large ferruginous rudely lenticular concretions, many of which measure 2 to 3 feet in length and 1 to 2 feet in width: these are very rich in fossils. The clayey shale itself is practically barren of any fossils. An abundant collection of marine fossils, in addition to plants and silicified wood, have been got in the concretions exposed in Vellarai, Nallur and Amarambedu.

The Southern Part

This part differs from the northern one in being occupied by a series of grits, sandstones and sandy clays, the exact relationship of which to the Sriperumbudur shales is not possible to know due to lack of sections in the intervening regions between the areas occupied by the former and the outcrops of the latter described above. But the likelihood is that the former is younger. Topographically also the southern half is separated from the northern Sriperumbudur basin by a rather high ground about half a mile north of the road leading to Walajabad.

The only good section can be seen at about a mile north-west of Umaiyaparanachcheri in the north side of the sourthernmost promontory of the Oragadam lateritic high ground close to the village of Vattambakkam. The thickness of the beds may be more than 30 feet made up of a variety of beds chiefly brownish reddish or whitish sandstones alternating with sandy, white or pale buff shales ; the white and pale buff arenaceous shales occurring at about ten feet from the bottom is very fossiliferous ; but the fossils are too difficult to be preserved owing to the very friable nature of the rock. The dip is 5°—10° east or east-south-east. No doubt the same series of beds continue northward as far as Vaiyapur and then westward to Mettupalaiyam occupying the whole of the high ground. In the bund of the tank south of Vaiyapur a yellow sandy shale outcrops, which is also fossiliferous. Further southeast a pale brick red sandstone underlaid by large gneissic boulder conglomerate is exposed in the bed of a nullah at Orattur. The beds are interesting in that the dip is westerly. South-east of and close to

44. Nallur is not marked in the Indian Atlas Sheet 78, but appears closely to approximate the position of village Bootundalum. It is, however, marked in the One Inch Sheet.

Vanjivanjeri[45] in an area of about an acre, occur large angular weathered blocks of a very coarse compact conglomerate of quartzite pebbles associated with yellow sandy clays described above at Vaiyapur. Nothing definite can be said about this conglomerate except that they resemble most in mineral character the Satyavedu conglomerate.

Outliers of the Sriperumbudur stage in the Region.

Outliers of the Sriperumbudur stage are to be seen at various places north-east, north, north-west and west of the principal outcrops described above. The first is displayed south of Sattarai tank, about 12 miles north-west of Sriperumbudur, below the laterite in a series of headlands rising out of the alluvium of the Old Palar valley. Several plant fossils have been got from the ferruginous concretionary sandy shales associated with the grey shales exposed on the south end of the tank; the beds dip at 4° or 5° in a more or less easterly direction. Further south a friable sandstone bed appears to overlie the shale beds and this is exposed at the northern end of the tank at Kilacheri where the general dip is 8° or 9° east, but in the west of the section the dip is about 2° west. Whether this is due to a small anticline or mere undulation is not definitely known. (2) An extensive series of sandstones, grits and shale beds about 100—150 feet in total thickness is exhibited at Palanjur[46] in an artificially made section for the channel (Bangaru channel), which leads the Cooum waters to the large Chembarambakam tank : a few *Estheria*-like forms and a cast of a bivalve were found there. (3) A series of sandstones and shales occur at Koppur about ten miles north-north-east of Sriperumbudur along the bank of a large nullah north of Koppur. The beds dip at 3°—5° north or north-east. Though only fragmentary badly preserved plant remains were reported by Foote, more plant and animal fossils are likely to be available there. (4) These shale beds appear to continue further north beyond the narrow alluvium of the Cooum and are exposed in a small rain gully falling from the south into a

45. Vanjivanjeri is not to be found either in the Indian Atlas Sheet 78 or in R. B. Foote's description; but Foote mentions a Vanjeri which is also not to be seen in Sheet 78. From the similarity in name together with the occurrence of the village in the area under review, I have taken Vanjivanjeri as the same as Vanjeri.

46. Palanjur of the One Inch Sheet appears to coincide with the position of Panjur described by R. B. Foote; the village finds no place in the Indian Atlas Sheet 78.

small tank east of Perumallapatti four miles W. S. W. of the Tinnanur railway station, 18 miles from Madras in the Madras—Arkonam section. (5) West of Sriperumbudur very friable and highly micaceous or gritty sandstones were met with in Kuttarambakkam on the sides of a small village tank and near Rajukulam along a rain gully joining the feeder channel of the large Tenneri tank. Though the sandstones were not fossiliferous the associated ferruginous concretionary sandstones have yielded ill-preserved plant remains and a cast of a gastropod. A very similar friable sandy bed was also met with in a well-section about a mile east of Vishar below 8 or 10 feet of gravel (Conjeeveram gravel of Bruce Foote); this probably represents the westernmost extension of the Sriperumbudur stage.

(5) *The outcrops south of the Palar.*

In addition to the four major outcrops north of the Palar described above, outcrops of the Jurassic rocks are to be found in the form of a large number of small patches south of the Palar. Of these a fairly important one is to be seen around the Mamandur tank west of the village of that name referred to as the Mamandur group by Oldham[47], while a little S. W. of this three more patches may be made out; in all about 25 very small patches have been identified in the Arcot taluk. Oldham reported several plant fossils (*Ptilophyllum, Pecopteris, Sphenopteris*) from the little yellow sandstone to be seen in a small tank west of Dusi village when the water is low and also from the materials taken out of it in deepening. These fossils, which are all land plants, mostly occur in thin bedded sandstone, but some have also been got from the coarser variety. The best section is to be recognised four miles west of Dusi along the supply channel from the Palar near Umaiyapuram to the Mamandur tank.

Three more fairly extensive outcrops of the Jurassic beds are shown in the Geological map south of the Palar. The beds mostly consist of buff, friable sandstone containing plenty of vague carbonaceous or vegetable markings: though in lithological characteristics they resemble the Jurassic formations occurring north of the Palar, no definite fossils seem to have been reported. It is likely that a careful search will reveal at least some fossils. The first one occurs east of the Uttaramerur and west of Nelvay with an approximate width of three miles east to west; the extreme length of the patch which is triangular with concave sides may be about five

47. North Arcot District Manual, Vol. I, pp. 18 and 19 (1895).

miles. The next one is to be seen around Padiri and west of Orattur; it is rather an elongated oval, the longer axis running N.E. to S.W. about six miles in length with the same breadth as in the last case; the southernmost outcrop of the district is to be recognised around Velangadu north-west of Perumberkandigal and west of the Acharapakkam hills; it is also more or less crescent shaped, but the concave side faces south-west; the yellow friable fine sandstone may be made out clearly in many well sections in and around the village Siruperpandi.

THE LATERITIC FORMATIONS.

Laterite[48] is a reddish to brownish clay-like residual rock[49] containing a good percentage of iron in the form of hydrated oxide or limonite; it is remarkable for its tendency to form concretionary, conglomeratic or gravelly masses abounding in vesicular, vermicular and scoriaceous cavities. When freshly quarried, it can be easily cut with a spade or axe but on exposure to weathering agencies most varieties harden due to dehydration and the vesicular

48. The term was first applied by F. Buchanan on account of the great usefulness of the rock as a building material in several parts of South India (Latin: *Later*, *Lateris*—a brick). "The most proper English name would be Laterite, from Lateritis, the appellation that may be given to it in science"—F. Buchanan, "A Journey from Madras through the countries of Mysore, Canara and Malabar", 1807, p. 440.

49. Clay also is a residual product of decomposition of rocks, the composition being $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$; but the distinction between clay and laterite is the small amount of combined silica in proportion to Al_2O_3 to be found in the latter. *Cf.* "Now clays are to be regarded as the end products resulting from one mode of superficial decomposition of rocks; and laterites as the end products of another totally distinct mode of decomposition. When a rock breaks down into clay hydrated aluminium silicate is to be regarded as the pure end product, all oxides being removed in solution. When a rock is converted into laterite on the other hand, the reverse holds; aluminium and the other silicates are decomposed and the silica is removed in solution, presumably in the colloidal form, whilst the oxides of iron, aluminium, titanium and manganese, which were relatively soluble under clay-forming conditions are relatively insoluble under laterite-forming conditions. The oxides of calcium, magnesium, sodium and potassium are separately soluble under both sets of conditions . . . *Pure clay* then is hydrated aluminium silicate, while *pure laterite* is a mixture of one or more, or all of the oxides of iron, aluminium, titanium and manganese more or less hydrated, which I refer to in this paper as the lateritic constituents".—L. L. Fermor, *What is Laterite?*, Geol. Mag., Vol. VIII, 1911, p. 459. Vide also J. W. Evans—The meaning of the term "Laterite", Geol. Mag., Vol. VII, 1910, pp. 189 and 190.

and vermicular appearance becomes pronounced as the result of removal of softer clayey material in the pores and tubes. In course of time, it also gets coated, probably by capillary and segregative forces, with a dark brown or black smooth coating of iron oxide, which forms a protective layer against further atmospheric action. On account of its scabrous appearance, it is called in Tamil, Chori-kal (சொறிக்கல்) or itch-stone. There is every gradation between this relatively hard compact variety to loose pisolitic gravel, which often passes into red coarse or fine sandy-clay or sandy loam.

The origin of laterite has long been a subject at issue, and it is not the aim of the present paper to enter into a discussion regarding the same. But what appears to the author as the most probable and what is accepted by most geologists at the present day is that laterite is formed as the result of decomposition of almost any kind of rock (unless it is one containing no trace of Fe. or Al. *e.g.*, pure Limestone) *in situ* as the result of segregative and capillary action of percolating or underground water under certain conditions which are[50]:—

50. C. S. Fox: "Bauxite", Crosby Lockwood & Son, 1927, p. 27. Also Mem. G.S.I., Vol. XLIX, pt. 1, pp. 6—10, 1923. *Cf.* At least in some localities laterites will have to be considered as not a direct weathered product but due to metasomatic or mechanical replacement.

The conditions for such a replacement according to M. Maclaren are as follows:—

1. Lateritic deposits are restricted geographically, because they require for their formation:—

(a) Tropical heat and rain with concomitant abundant vegetation.

(b) Alternating wet and dry seasons.

2. Their restriction in altitude is only apparent. Their present lines of alteration merely mark ancient or existing basin floors or plains.

3. They are derived *from mineralized solutions brought to the surface* by capillarity, and are essentially replacements (either mechanical or metasomatic) of soil or of rock decomposed *in situ* or of both.

4. In the humid regions of India the tendency of change in laterites is towards hydration and not towards dehydration." Geol. Mag., Vol. III, 1906, p. 546.

L. L. Fermor also corroborates with the conclusion of M. Maclaren in the formation of those lateritic deposits to be found over the Dharwar formation.

L. L. Fermor distinguishes between the following types of Laterites: (1) *Typical laterite* containing 90-100% of lateritic constituents; (2) *Quartzoze laterite* with 50-90% of lateritic materials, *but rich in quartz*; (3) *Lithomargic laterite*, rich in Kaolin or litho-marge with 50-90% of lateritic constituents; (4) *Detrital laterite* when mixed with extraneous materials, but

(*i*) A tropical or subtropical climate subject to dry and wet seasons or monsoons alternately.

(*ii*) An elevated level or gently sloping land surface imperfectly drained and subject to not appreciable denudations.

(*iii*) The more rich the exposed rock is in alumina, iron oxide or TiO_2 or MnO_2, the thicker the depth of laterite.

(*iv*) The infiltering water to remain for fairly long periods so that the interspaces of the weathered rock are filled with it, but to drain away or dry up in the hot season.

The areas occupied by laterite are usually very barren and stony except for, here and there, a few large trees; but in the Allikkuli and Satyavedu areas, it is covered by scrub jungle. Shingly to pellety lateritic areas are characteristically barren and highly slippery due to the smooth rounded nature of the pellets.

Age.

Most of the lateriate found near Madras are secondary or detrital in origin with the possible exception[51] of those to be found over the various Jurassic formations consisting of a fairly compact nature (however, *vide infra*). As the present climate of the east coast is not moist enough to give rise to laterite, the age of the massive and compact laterite must be at least Pleistocene, when the climate must have been moister; or earlier than the Pleistocene. Anyhow, it cannot be older than the lower Cretaceous,[52] while

containing 40-100% of lateritic constituents. Poorer varieties may be described as lateritic litho-marge, lateritic sand and lateritic soil.

51. Speaking of the laterites of the Madras Presidency, Mysore, Coorg, and Travancore, C. S. Fox states: "It is not necessarily all detrital laterite, but possibly the lateritised soil and debris which was left in isolated patches in situations suitable for lateritisation during the process of denudation of the whole country". Mem. G.S.I., Vol. XLIX, pt. 1, 1923, p. 187.

52. A somewhat similar view has been expressed by C. S. Fox, who states "that there is no laterite in India which is older than the beds of Upper Cretaceous age although there are laterites of all subsequent epochs and laterites in process of formation to-day."—C. S. Fox: "Bauxite", 1927, p. 27, Crosby Lockwood & Sons.

He also states elsewhere that "in India there is no record of lateritisation earlier than the beginning of the Eocene times," (Mem. G.S.I. Vol. XLIX, pt. 1, 1923, p. 44) because the formation of the Arabian Sea and hence also the monsoonic conditions in most of the Deccan area dates only from the breaking up of the Gondwana land at the close of the Cretaceous period. But it appears probable that the monsoonic conditions might have begun

possibly some of the detrital laterite covering a wide region may date from that period, it appears to belong mostly to the Pleistocene.

The lateritic formations rest unconformably in most places where they are detrital on denuded older formations as the Sriperumbudur shales, or the gneisses. In the Allikkuli and the Satyavedu areas there appears to be a gradual transition between the Jurassic conglomerates and the overlying laterite conglomerates, so that the latter appear to be a mere disintegration product of the former. *It is interesting to note that in most cases they rest upon the upper Gondwana outcrops unconformably, and in many cases they also overlap on to the gneisses.*

No fossils have been found in the laterites, except some secondary ones as silicified wood, washed up from older formations. But *a large and interesting collection of Palaeolithic implements have been got from them at various depths in the detrital laterite.* Though the area covered may measure several hundred square miles, the thickness of the formation is very meagre ranging from a few inches to a few feet.

Superficially the lateritic exposures fall into three divisions *viz.*: (1) those consisting of solid or recemented compact laterite (2) coarse conglomeratic laterite and (3) shingly to pellety laterite. No definite stratigraphic relationship has yet been made out between the three divisions, except that the first appears to be the basement plateau of the early Pleistocene times gently sloping towards the sea, consisting at various places and at various levels of coarse conglomeratic laterite containing angular fragments and of the shingly to pellety laterite, the former probably being the result of rapid sub-aerial weathering and the latter probably as detrital material deposited along gullies and river valleys, and hence both are younger than the first variety. This compact lateritic plateau must have been formed when the East Coast of India had a very moist climate probably like the present climate of the West Coast, conducive to the formation of laterite; and the present general height of the plateau is more than 100 feet above the mean sea level.[53] This plateau has been denuded and partly or totally removed in many places and on this denuded part resting either

earlier in the East Coast, as what is now the Bay of Bengal must date at least from the close of the Jurassic period.

53. *It is 125 feet in the Red hills and near Manjankaranai about 111 feet.*

on the compact laterite or still older formation occur the conglomeratic laterite or the pellety laterite.

Compact Laterite.

The typical exposures of solid or compact laterite of recemented pellets are to be seen at the Red Hills, which consist of hillocks rising to about 125 feet above the mean sea level and 80 feet above the surrounding country, bordering the Red Hills or the Pulal lake and the Cholavaram tank. Naravarikuppam[54] situated on the north-eastern banks of the Red Hills lake is an interesting site, in that it not only offers a good exposure of lateritic formation but also shows a large number of prehistoric stone circles or dolmens. The somewhat detrital nature of the laterite is revealed by the frequent occurrences of rounded quartzitic pebbles in it. The Red Hills typical laterite plateau extends as far north as Erumaivettipalaiyam on the southern banks of the Korttalaiyar. An interesting outlier is to be seen north of the river at Manjankaranai in a hillock rising about 60 feet above the surrounding plain. The summit consists of typical laterite passing down to angular fragments of laterite lighter in colour, which is underlaid by mottled coarse angular grit rather white in colour due to the cementing material being chiefly calcium and strontium carbonates with a little amount of alumina. The conglomerate becomes very coarse as one proceeds westward so that the boulders measure frequently one foot to two feet in size, near the Allikkuli and the Satyavedu hills. The same type of laterite may also be seen in the high ground S. W. of the Red Hills especially north and north-west of Avadi; further south near Sriperumbudur and Irumbedu;[55] around Oragadam about eight miles south of Sriperumbudur; at Tirumangalam; at Kandur; in the high ground south-west of Ariyavakkam; a small patch south of and opposite to Tiruvallur railway station. It also covers extensively the south end of the tank at Karadiputtur; at Budur; south of Satyavedu; at Siruvadu; at Amarambedu; at Madarpakkam; at Pondavakkam; further north-east at Kannambakkam; further south-south-east of Ama-

54 Narraincoopum of Indian Atlas Sheet 78 and R. B. Foote's description was situated on the northern banks of the original Red Hills lake; the village appears to have been shifted eastward near the north main road as the result of increasing the water capacity of the lake to supply Madras City in 1872, and also to prevent them from polluting the lower supply channel.

55. This is spelt Yerrember in the Indian Atlas Sheet 78.

rambedu it is also recognised extensively at Kollanur;[56] at Peripuliyur[57] and as far north as Yigavaripalem; further eastward it becomes gritty or clayey being mixed with sands and lateritic pellets.

Coarse Conglomerate.

Those patches of laterite occurring north and north-west of Tiruppachur and south of the Korttalaiyar is coarsely conglomerate: the same feature is more pronounced near and along the foot of the Allikkuli and the Satyavedu Hills. R. B. Foote considered a well section near the village Sedulappakkam[58] as the best exposure showing extra-ordinarily coarse conglomerate.

Shingly Conglomeratic Laterite.

Lateritic formations bordering the Nagari river valley in the north and south sides are shingly in character with very little laterite cement between the pellets. Plenty of stone implements occur in the shingle beds south of Harichchandrapuram[59] near the Tiruvelangadu railway station and east of Takkolam in the Korttalaiyar valley. South of the Narayanavaram, coarse laterite shingle occurs at Pennalurupet, Gunipalaiyam and further west extending into the valley of the Allikkuli Hills. Further eastward, it is seen discontinuously at Kachchur all along the northern slopes of the high ground as far as Vadamadurai, where it is well displayed in the north-west side of the great tank and reappears in the elevated region west of Vengal, north of Sembedu, north of Meyyur and extending further west to the small scarps at Kunjaram.[60] North of the Narayanavaram or Arni river a more or less similar, but less coarse shingly laterite is exposed at Tamarakuppam[61] and near Senjiagaram rising abruptly to about 30 feet

56. This appears to coincide with Colanur of R. B. Foote's description; it is not however marked in the Indian Atlas Sheet 78.

57. The place Peripuliyur of One Inch Sheet coincides with Pullore of the Indian Atlas Sheet 78 and R. B. Foote's description.

58. This village appears to correspond in position to Callapanidoopettah of the Indian Atlas Sheet 78, and Callapanaidoopettah described by R. B. Foote; the village is not marked in One Inch Sheet.

59. This, as elsewhere pointed out, coincides with Catramatoor of Indian Atlas Sheet 78 described by R. B. Foote.

60. This is not shown in the I.A.S. 78, but its position can be located at about a mile due east of Nelway (Nelvay of the One Inch Sheet).

61. This place corresponds to Junglepilly of R. B. Foote's description; evidently the name of the village has been changed.

above the alluvium. The lateritic area in the Palayanuru region is very thickly strewn with extremely coarse quartzite shingle, evidently weathered from the lower layers.

These lateritic formations have drawn a great deal of attention as the result of the abundant and varied occurrence of palaeolithic artifacts of the prehistoric man of the neighbourhood of Madras; the more important workers were R. B. Foote, whose pioneer work has not probably been excelled by any other worker in the field, F. J. Richards, L. A. Cammiade and M. C. Burkitt[62] and in more recent times T. T. Paterson and V. D. Krishnaswami. Messrs. F. J. Richards, L. A. Cammiade and M. C Burkitt have been able to recognise the following facts from the succession of beds in a flat topped hillock rising some 60 feet above the alluvial plain and 111 feet above the sea-level near the village Manjankaranai.

(5) Grey soil	.. 1 foot.
(4) Midden refuse of Pottery & Neoliths	.. 1 foot.
(3) Compact laterite gravel rounded and pellety	.. 6-8 feet.
(2) Angular fragments of laterite, light in colour	.. 3 feet.
(1) Solid laterite.[63]	

(1) Palaeoliths *in situ* were found between (2) and (3) in the abrupt junction between the two stages.

(2) Stage (3) appears as a sort of rubble filling up pockets in the underlying laterite, being washed down and filling cavities in gullies in (1) which is the original lateritic plateau situated well over 100 feet contour, formed probably from the Tertiary to early Pleistocene times.

(3) The climate which was conducive to the formation of (1) must have been more moist than the present; hence the area must have been thickly forested not suitable for a dense population of the Palaeolithic men.

(4) Stage (2) represents a change of the climate to a drier one with less vegetation, and hence suited for the lower palaeolithic culture.

(5) Stage (3) shows a return to moist conditions with a heavy rainfall which destroyed the larger part of the lateritic plateau and deposited the debris in gullies and pockets; hence they also contain palaeoliths; the moist condition was responsible for the removal of colloidal silica in the implements found in (3).

62. Geological Magazine, Vol. LXIX, May 1932 with notes on the petrography by S. W. Wooldridge and conclusions by P. Lake.

63. What is stated as solid laterite cannot be called laterite as it consists of angular gritty quartz pieces in a cement consisting chiefly of Calcium Carbonate; that is probably the reason why R. B. Foote referred it doubtfully to the Cuddalore sandstone.

(6) The typology of the Neoliths in (4) reveals a new culture quite different from that belonging to the lower stages.

Mr. V. D. Krishnaswami after a careful study of the area came to the following conclusions :—

(a) that the lateritic peneplain extending from the Allikkuli and the Satyavedu Hills to almost the coast approximately at a height of 100 feet above the Old Palar may be clearly made out.

(b) that tentatively in this peneplain T_0, three more river terraces T_1, T_2 and T_3 at levels approximately 60′ 20′ and 8′ respectively above the Old Palar or Vridhakshiranadi may be recognised.

(c) that the terraces T_0 and T_2 correspond to clear pluvial periods, while T_1 and T_3 appear to be drier, though nothing definite can be said regarding them.

(d) that palaeolithic implements have been discovered not only in the terraces, but also, in the weathered laterite, detrital laterite, and the boulder conglomerates, thus revealing that man had already appeared on the scene, before the deposition of the boulder conglomerate.

To depositional peneplain may be seen typically at Vadamadurai in a section revealed in a recently dug up tank where the terrace can be recognised further west at Pundi, Sitanjeri and Kunjaram. T_1 or 60 feet terrace is seen near Attantangal on the banks of the channel connecting the Cholavaram tank with the Red Hills lake; in the sandy loam covering this terrace many implements were found. T_2 or 20 feet terrace is displayed near the village Attirambakkam covering a large area and extending as far as the Nambakkam tank. The tools found therein are rich in variety and form; the terrace is seen imperfectly on the right bank of the Korttalaiyar round about Pundi. T_3 or 8 feet terrace is displayed only at Erumaivettipalaiyam. The author recognised definitely in all *five* cultures corresponding to the three stages shown in section at Vadamadurai, the T_1 and the T_2 terraces; the sixth industry characteristic of T_3, according to him, is yet to be made out clearly.

Decidedly, more thorough investigation is absolutely necessary before placing these inferences on a firm and convincing basis, firstly, in fixing definitely the course of the Old Palar or the Vridhakshiranadi, and secondly in tracing the various terraces along its sides taking account of the spot-heights and river profiles, the geologic or lithologic and the cultural features.

CONJEEVERAM GRAVEL.

The rather raised ground northwest, north and north-east of Conjeeveram town is occupied by a peculiar quartzite gravel deposit characterised by the absence of ferruginous matter as compared to the overlying lateritic formation. The area is bounded on the north by the Old Palar and on the south by the Palar alluvia,

which meet each other further westward at about three miles south-east of Kaveripak at Vegamangalam, which hence represents the western-most extension of the gravel formation.

Good sections may be made out (1) along the banks of the Tenneri tank oft-flow channel north of Devariyambakkam (2) in a ruined well near Injambakkam, (3) in the off-flow channel of the tank at Karai, where it rests conformably on white friable grits; (4) in Vedal, where it is conformably overlaid by lateritic gravel: (5) in a well section at Damal, where 3½ feet of greyish red, gritty, coarse lateritic sand rests on false bedded gritty friable felspar gravel exposed to about 10 feet in depth; the same may be seen along the banks of the channel leading to Damal tank from Avalur; (6) in the channel leading to the Parandur tank; (7) in the valley running eastward from Siruvakkam to the Tenneri tank; (8) In a well three fourths of a mile east of Vishar, the Conjeeveram gravel 8 or 10 feet in thickness rests on what appear to be Jurassic beds of friable shaly sandstone.

As R. B. Foote had reported a number of stone-implements in the shape of axes and spear heads in the gravel beds between Akkampuram and Singalpadi, the age of the formation might be considered the same as that of the lateritic deposits to be found further east of the area.

ALLUVIAL DEPOSITS

These fall under three heads viz., marine, estuarine and fluviatile; the distinction between the regions occupied by the first two cannot be made out, as one gradually merges into the other, while only to some extent fluviatile or river alluvium can be definitely marked off from the areas occupied by the other two in the coastal regions. Hence, their rough relative positions only will be attempted to be fixed.

The area under consideration has been subjected to one major or principal uplift at the close of the Jurassic period; the presence of the Jurassic outcrops at various widely separated places below and surrounded partly or wholly by the lateritic formations, suggests that very likely the original limit of land due to this upheaval must roughly coincide with at least the present extension of the basal or compact lateritic formations. The region east of the laterite, forming the estuarine and coastal alluvia, must have been the result of the accumulation of the terrigenous débris in the depressions in the coastal parts and in the continental slope, ever since the upper Jurassic times.

The accompanying geological map of the area suggests, that the present Palar river course is mostly in the gneissic region; and as the recent fluviatile alluvium overlies the laterite or the Older Alluvium in places, the age of the present course of the river is decidedly post-lateritic. Remembering that the peninsular gneisses and the associated igneous rocks are very hard materials offering great resistance to erosion and weathering forces, as compared to the sedimentary formations to be seen a little further north, it appears rather strange that the Palar should behave in this manner. Thus, there appears to be every reason to believe, that it might have had a different and a more northern course through the less hard sedimentary formations in the near historic and probably also geologic past. There are also definite historical evidences to show, that the Palar had a more northern course running north of Conjeeveram town at the close of the eleventh or the beginning of the twelfth century.[64]

64. (1) Jayamkondar's *Kalingaththu Parani*, Edited by A. Gopalayan. In verses 354-356, Jayamkondar, who was a poet of the time of Rajendra Cholan (1070-1119 A.D.) enumerates the rivers crossed by the troops in their march towards the north for the war against the Kalingadesa; the war might have taken place between 1095-1115 A.D.

"பாலாறு குசைத்தலை பொன் முகரிப்
பழவாறு படர்ந் தெழு கொல்லி யெனு
நாலாறு மகன் றொரு பெண்ணை யெனு
நதியாறு கடந்து நடந்திடனே"

Vide also, the foot notes for the verse by the Editor, who had cited a change in the course of the Palar near Gudiyattam; this appears rather irrelevant as further eastward, there appears to be a definite geological evidence to show that the Palar flowed north of and near to Conjeeveram.

(2) *Vide*, B. M. Thirunaranan: The Rivers of the Palar Basin, Jour. Mad. Geog. Asso., Vol. XIII, No. 2, p. 155.

(3) One Gundu Gopal Row, a deputy of the Hindu King of Vijayanagar, was said to have excavated a channel which diverted the Palar from its old course, the *Vridhakshiranadi* to its present course by the village of Orikai.—C. S. Crole, The Chingleput District Manual, 1879, p. 118.

Vide also, A. F. Cox & H. A. Stuart: The North Arcot District Manual, Vol. I, p. 7 (1895), where the said Gundu Gopal Row is described as probably a servant of the Raja of Conjeeveram.

(4) "At Kondapuram, near Kaveripak, an inscription on the walls of a temple describing its position as being south of the Palar, whereas it is situated to the north of the river, which shows that the course of the river was changed after the temple was built."—Hon. Yakub Hasan in his address

However, there appears to be no definite historical evidence to show what the exact course of the Vridhakshiranadi was, before its diversion to its present course. The accompanying geologica map shows that Conjeeveram is situated on a rather high ground consisting of the older Conjeeveram gravel and that there is north of this a shallow valley consisting of the younger or the recent alluvium; as this valley starts from about ten miles east of Arcot, and joins with the present Palar valley a little further east near Walajabad, it appears possible that before the diversion to its present course (probably by Gundu Gopal Row), the Palar might have flowed along the valley north of Conjeeveram.

Again, the geological map reveals another arm of the river alluvium starting from a little west of the one just described above but running N. E. ward widening in that direction. This marks clearly the course of an old river, which must have been larger than the Palar as shown by the width as well as the coarseness of the alluvium which consists of coarse sand and gravel. R. B Foote has recorded a tradition of the people that the Vridhakshiranadi flowed near the village Palur, which is now situated in the alluvium of the Old Palar. He has also pointed out, that where the river alluvium starts some eleven miles east of Arcot are situated gneissic protuberances in the river bed opposite the villages Vegamangalam and Mamandur, where the bed narrows considerably and the raising of the river bed during some great flood above these must have diverted it a little southward where the "fall of the land surface was more rapid." Probably, the course of the river before such a diversion would have followed the Old Bungaru Channel or the Place's Canal, and then turned eastward and flowed along the present Cooum river to its mouth a few miles west of Poonamallee. It is very difficult to fix the date and period, when it flowed along the Cooum valley; it is likely, as inferred from the references already cited, that this might have been the course of the old Palar earlier than the end of the eleventh century.[65] This

to the owners of land fed by the Palar at Pudupadi on April 22, 1939. This is evidently taken from the North Arcot District Manual.

Vide, A. F. Cox & H. A. Stuart, North Arcot District Manual, 1895, Vol. I, p. 7.

65. *Vide* also, B. M. Thirunaranan's article on the site and situation of Madras in the Madras Tercentenary Commemoration Volume, p. 332 footnotes: "The Cooum is known as the old Palar at Tiruverkadu, a village two miles north of Poonamallee and close to the river. (p. 227, *Sivasthala Manjari* in Tamil edited by V. T. Subramania Pillai, Madras, 1931)."

nference, as pointed out by R. B. Foote, is supported by geological evidence in that a wide branch of the coarse Old Palar alluvium may be traced diverging from the still more important valley of the river (vide infra) just west of Tiruvallur R. S., and continuing along the course of the Cooum till it reaches the estuarine alluvium a little west of Poonamallee at the villages, Sittukkadu and Tirumahishai and along the New Bungaru Channel westward.

A very important and very wide branch of fluviatile alluvium running north-eastward from the Place's or Old Bungaru Channel between Tiruvallur R. S. and the lateritic hillock at Pundi, is also indicated by the geological map; this alluvium finally merges with those of the Korttalaiyar and the Arani rivers; as shown by the width and coarseness of the alluvium consisting of gravel and coarse angular sand particles, this river must have been larger and the current more powerful than the present Palar. The bulge in the coast line between the mouths of the Korttalaiyar and the Arani, makes us conclude that the old Palar must have embouched into the Bay of Bengal slightly north of the Ennore backwaters. The general climate, which must have been prevalent on the east coast when the Palar flowed in this direction, must have been much moister than at present: as plenty of palaeolithic stone implements of Abbévillian to late Acheulean age have been collected *in situ* from the terraces of this river, we conclude, that the river must have formed a very important physical feature, and probably also a cultural centre, during the Middle and Upper Pleistocene times, when the primitive man dwelt in this part of India.

The probable cause for the successive changes in the course of the Palar is difficult to be made out definitely; R. B. Foote has pointed out that if the course is a natural one, it must be due to silting up of the Old Palar river valley, and its diversion by itself during some great flood. In addition, we shall have to remember, that the drainage of the area has been to a very large extent interfered with by human agency, chiefly for purposes of irrigation either by damming up the river, or by diverting its freshes through channels to tanks or lakes: thus, one of these attempts either deliberately or accidentally, might have resulted in the change in the direction of flow of the river. An instance cited above in the reference, stating that one Gundu Gopal Row diverted the river from flowing north of Conjeeveram to its present course might be taken as an evidence to show human interference with drainage.

But it appears to the present writer, that the following facts, showing a gentle submergence and tilting of the region towards south-east, might have helped the above causes to a less or greater extent:—

1. It has been remarked by those geologists, and archaeologists, who have visited the Shore Temple of the Seven Pagodas, that the region appears

to have been submerged even during historic times. Thus, an old road in the area has been discovered by archaeologists at a level of five or six feet below the present level. "Lord Napier, then Governor of Madras, visited the spot about a week after the snake deity was dug up, and had excavations made to a depth of 7 or 8 feet, which exposed a great number of figures and animals and showed that the old road must have passed in front of the rock at a depth of five or six feet below the present level . . . ".[66]

2. R. D. Oldham seems to agree with Capt. T. J. Newbold, when he stated that the "St. Thomé, a short distance south of Madras is said to have been formerly situated twelve leagues inland and forty miles further south, the town of Mahabalipuram is said to have been overwhelmed by the sea".[67] "I was informed by Lord Elphinstone and Mr. W. Elliot, that whenever a storm took place from the seaward. Roman and occasionally Chinese coins were cast upon the beach. One of the former, according to Mr. Norton, is of the reign of Valentinarius. General Fraser informs me that south of these ruins, at Ariacoopang and Cuddalore, pieces of brick, tiles and pottery are taken up from the bed of the sea at considerable distance from the shore, beyond the recoil of the tidal wave. Still further south near the embouchure of the Cauvery, the Brahmans point out the submerged site of another ancient city.[68] At Madras, from all I can collect from the oldest inhabitants and survey, the sea has certainly encroached latterly on the ground it formerly occupied while St. Thome[69] an ancient Portuguese settlement, a little south of Madras, is traditionally said to have stood twelve leagues inland.[70] It would appear that, there is not much of definite evidence to show a submergence of a coastal strip to the extent of twelve leagues; but it is quite likely, that a submergence of a few feet might have been exaggerated by the people.

3. As already pointed out, a strip of land, in the S.E. portion of Madurantakam taluk, bounded on the east by the sea and the Kaliveli tank on the south, called Yedakeinadu or left-hand-land, appears to have been by tradition, once separated from the mainland by an irruption of the sea.[71] The present continuity of land may be explained as due to filling up of the

66. Quoted from Dr. Hunter's work on the Seven Pagodas, C. S. Crole: The Chingleput District Manual, 1879, p. 98.

67. R. D. Oldham, Manual of the Geology of India, p. 12.

68. This is evidently the famous Kaverippumpattanam of Tamil literature mentioned in *Chilappadikaram.*

69. St. Thome was definitely a Portuguese monastic settlement about 1522 A.D., under the name of San Thomé de Meliapor; traditionally, however, it is associated with the Apostle Thomas, and hence, must date back to the first century. The place probably meant here is the adjacent place of Mylapore which appears to be older than San Thomé being possibly the Malliarpha mentioned by Ptolemy.

70. Capt. T. J. Newbold: Summary of the Geology of Southern India, Jour. Roy. Asia. Soc., Vol. VIII, p. 250, 1846.

71. C. S. Crole, The Chingleput District Manual, 1879, p. 128.

shallow lagoon-like depression, which must have separated that strip of land.

4. The thickness of recent coastal alluvium above the gneissic rocks in the coastal belt shows that as one proceeds from Madras southward, the depth increases; it is almost about 58 feet in Madras, but a boring put in Pondicherry did not reach the basement gneiss even after a depth of 550 feet.[72]

It must be remembered, that the unusual thickness of coastal alluvium in Pondicherry is due to its situation in the Pondicherry-Cuddalore bay, which was bigger than the Madras-Poonamallee bay; making due allowance for this, it appears to the author, there is a considerable depth which could be only explained as due to a sinking continental shelf.

5. R. B. Foote also appears to imply a slight lowering of land on the S.E. of the region under consideration; for he does not explain, why the fall of the land is more rapid in an eastern direction than in the old bed.[73]

Again he has noted that "a few yards to the west of the small channel above Kalingula, a part of the grit bed about 40 feet long and 1½ to 2 feet thick has been pushed up into a vertical position and protrudes above the surface like a small dyke.[74] Evidently, this must have taken place due to and during the tilting of the area. R. B. Foote also suggests the probable occurrence of a fault in the Allikkuli area as inferred "from the peculiar nature of the case," i.e., the shale bed occupying the western part, and the conglomerate the middle part without any visible transition, due to the accumulation of the conglomerate debris.[75]

6. Mr. V. D. Krishnaswami, who has been carefully studying the lateritic deposits in the Red Hills area near Madras, has also come to the same conclusion, *viz.*, that the land has been tilted towards the S.E. He appears to have recognised a fault, which he is trying to date by the help of the Pleistocene terraces. This was the result of a discussion, which the author had with him after these pages had been written, and when they were about to go to the press.

It is interesting to note, that the course of the Korttalaiyar east of the Allikkuli hills follows close to the lateritic formation and the Sriperumbudur shales to be seen on the northern side of the

72. R. D. Oldham, Manual of the Geology of India, p. 404, *vide* also, *op. cit.* p. 10 "near Pondicherry, beds of peat at various levels below the surface of the ground show that there has been subsidence".

Though we have no data to depend upon, it is likely that the coastal alluvium will decrease in thickness as one proceeds south till Mahabalipuram where charnockites are exposed; then very likely, it will increase steadily up to Pondicherry; anyway it does not affect the argument.

73. R. B. Foote, Mem. G.S.I., Vol. X, part I, 1873; p. 21.

74. *Op. cit.*, p. 102.

75. North Arcot District Manual, 1895, Vol. I, p. 16.

river; and it is still more surprising, that it should run between two lateritic hillocks, between Pundi and Rangapuram lateritic hillocks. It appears to the present writer, that in this portion of its course very probably the Korttalaiyar is actually running in the valley of a tributary of the Vridhakshiranadi, and its course (that of the Korttalaiyar) closely following the lateritic high ground must be explained as due to deepening of the valley as the result of greater amount of torrential water brought by the various impetuous streams viz., the Attirambakkam, the Odapai and the Meyyur nullahs from the north resulting in greater erosion, and the consequent diversion of the Nagari, and probably, a little subsequently also the Korttalaiyar along the course of the tributary valley, which hence, became the main valley.[76]

R. Bruce Foote has also suggested that the Nagari river undoubtedly would have run N.E. ward and joined the main Narayanavaram or Arani river in the recent past, instead of taking a S. E. course a little east of Nagari village, and joining the Korttalaiyar. The place of such a diversion appears to be at a place about 3 miles east-south-east of the Nagari village, where the gneissic rocks together with dolerite dykes are exposed in the river bed in the form of a neck. The increase in the width and extension of the alluvium along the present course of the Nagari river below this place, and the wide patch of alluvium in the dry subsequent valley running N. E. ward occupied by a small stream, a tributary of the Arani for some distance in the lower portion, confirm this inference. It is probable, that a smaller tributary of the Nandi or Tiruttani river might have occupied the lower portion of the present Nagari valley, and this stream by head erosion might have made possible the diversion of the Old Nagari river flowing N. E. ward to S. E. ward; [77] the gradual small tilt of the land referred to earlier might have made the diversion easier.

76. Cf. R. B. Foote's statement "It is uncertain whether this passage (*i.e.*, the one between the lateritic hillocks near Pundi) was forced by the water of the united Corteliar and the Naggery river or whether it had already been made by the Old Palar. There is no distinct evidence on the subject, but the probability is the passage was forced by the Old Palar river after it had silted up its valley in the narrower part lying between Trivellore and Nemaly (Neyveli) to a height sufficient for its water to flow into what undoubtedly was an old valley formed by denudation during the period of elevation which raised the implement bearing laterite to its present position."

77. "And in the case of the Nagari river, from the fact that the cutting through the gneiss by which the river escapes from its old alluvial valley

The deposits of the Korttalaiyar consist of reddish loam or loamy sand, sometimes intermixed with a good proportion of clay. A good deposition is to be seen between Illuppattandalam and Takkolam. The relative position of the two alluvia viz., the Old Palar and the Korttalaiyar may be seen east of the railway line between Arkonam and Conjeeveram.

The alluvium of the Palar is fairly coarse to fine grained sand, but consists locally of gravel or clay ; all these materials are mostly derived from the gneissic and other rocks of the North Arcot district. Fluviatile clay deposits are to be seen near Chingleput and further east near its mouth forming some swampy areas.

The Old Palar or Vridhakshiranadi alluvium is coarse sandy, or gritty, or gravelly with a paler reddish colour, as compared to that of the Korttalaiyar ; several lateritic outcrops, much of which have now been removed for road material, may be seen surrounded by it near Tiruvallur R. S., and the coarse sandy nature continues till its junction with finer marine sand west of Poonamallee. In the N. E. valley of the Old Palar, one can recognise the same characteristic angular particles of gritty sand, but it occasionally becomes mixed with clay washed down from the adjoining higher lateritic formations.

The fluviatile deposits of the Narayanavaram river consists of pure sand associated with quartzite boulders, pebbles, gravel and ferruginous material derived from the older lateritic and the Jurassic formations.

In the region of Madras there was an extensive, but shallow bay extending from the coast to a little west of Poonamallee during the Pleistocene and earlier times ; this bay was converted into an estuarine one when the Old Palar or Vridhakshiranadi was diverted from the northern course to flow along the present Cooum valley, probably, during the late Pleistocene times. The limits of the bay is to be traced by the presence of black sticky clay in practically the whole of the basin at various depths from 0 to 50 feet or slightly more, according to distance from the original shore and depth of the sea, except in or near the bed of the Old Palar where it con-

presents every appearance of being of artificial origin, and must in that case have been the work of a people boasting some considerable civilization."— R. B. Foote in the North Arcot District Manual p. 22. *Vide* also, *Ibid.*, p. 7.

sists of coarse sand, and along the shores of the original bay, where it consists of fine-sand.[78]

Thus, we may more or less trace the boundary of the bay from the mouth of the Adyar westward along the alluvium of the same river to Anakaputtur, then along the north-eastern part of the village Kunnattur turning N. W. ward to a little west of Poonamalle to Tirumahishai and Sittukkadu then continuing eastward along the bed of the Cooum to Ayapakkam; it finally turns N. E. ward closely following the south-eastern extension of the lateritic plateau, which extends approximately to the eighth mile on the *northern trunk road.* Between Anakaputur and Kunnatur one finds black sticky clay indicating the original presence of the Pammal tank. From the coast as far as Poonamallee the deposit consists of pure fine drab sand: further westward, this fine sand becomes mixed with estuarine clay, while near Tirumahishai and Sittukkadu the fine marine sand is associated with coarse gritty sand

78. Some recorded well-sections in Madras:—

1. B. Babington: Tran. Geol. Soc. of London Vol. V, Series I, Jan. 1819, pp. 337—338.
2. T. G. Taylor, Mad. Jour. Lit. & Sci., Vol. XIV, 1847, pp. 183—186.
3. Vredenburg: Mem. G.S.I., Vol. XXXII pt. I, 1901.
4. Capt. Newbold, Jour. Roy. Asia. Soc., Vol. VIII, p. 249. Experimental borings of the earth at the Land Custom House, Madras. 1832. (The Land Custom House appears to coincide with the Madras Museum compound).
5. *Vide* also R. B. Foote, Mem. G.S.I., Vol. X, pt. I, 1873.
6. W. King Rec. G.S.I., Vol. XIII, pt. 2, pp. 115, 136—138.
7. B. M. Thirunaranan, Madras Tercentenary Commemmoration Volume, p. 331 foot notes.

In all these wells black sticky clay was met with at various levels containing estuarine fossils and the gneiss struck at about 58′ or 60′. In a well section sunk recently in the Spur tank, Egmore, the following sequence was observed by the author:

0 - 6′—Brownish gray clay.
6′-12′—Coarse loose sand stained with iron oxide.
12′-20′—Grayish black to black sticky clay with oyster shells.
20′-34′—Loose sandy clay with iron stains here and there.
34′-40′—Loose fine sand with greenish yellow clay mixed intimately.

The well was deepened a little later, when at approximately 45′ some calcareous rocks with good fossils of Ostrea sp. Pecten sp. and ramified coral (?) like calcareous structures were found. At approximately 40′ or a little below that level small smooth sub-angular gravelly pebbles of Charnockites and gneiss together with sub-angular smooth brownish chert pieces were found.

of the Old Palar. The junction may be traced along the New Bungaru Channel to Perumallapatti where they meet the Sriperumbudur shales. Eastward, the village Ayapakkam stands on coarse sand of the Old Palar at a height of about 10 feet above the general level of the estuarine plain.

During the last stages in the filling up of the bay, chiefly by the alluvium brought by the Old Palar and to a certain extent also by the Adyar, several marshy tanks or lakes must have been formed, some of which might have been freshwater, some others brackish or bitter; evidently, due to drying up of these latter tanks minerals like Selenite, fibrous gypsum etc. have been reported in various places when digging wells. (e.g. Northern part of Madras City, Poonamalle).[79] The brackish water got from some localities in the city is another evidence towards the drying up of some back waters or inland lakes. The various tanks which may be recognised at present, or which have been filled up partly or wholly as: the Spur tank, the Pammal tank, the Ambattur tank, the Long tank or the Mambalam tank, the Nungambakkam tank, the Vyasarpadi tank, the Perambur tank, etc., are the relicts representing the very last stage in the filling up of the extensive estuarine lake. The mouth of the bay must have been to a large extent closed by long sand bars and dunes similar to those to be found north and south of Madras along the coast; one sand dune as already pointed out is to be seen prominently north of the New University Examination Hall, west of the Beach Road in Madras.[80] That these extensive marshy conditions must have persisted during late historic times there can be no doubt, and most of them were drained and filled up only when the City of Madras began to grow in population in the last three centuries, thus bringing about a considerable change in its topography.

79. Ten years' correspondence on the Resources of India with reference to Mr. Greenough's Geological Map of India, pp. 40, 43, 49 & 51.

80. Mr. B. M. Thirunaranan by the help of old maps has recognised several sand dunes in the city, Mad. Tercentenary Commemmoration Volume, p. 330.

A Panoramic view of part of Fort St. George, depicting the Fort as it looked in 1718, by Jan Van Ryne, a Dutch engraver, reproduced in Prof. C. S. Srinivasachari's article on the Maps of Old Madras, published in the Jour. Mad. Geog. Assocn., Vol. III, 1928—29 as Map IV (b) reveals a few mounds, which appear to be sand dunes. One of the mounds with a building on its top Col. Love suggested might represent St. Thomas Mt.; this the author of this paper thinks extremely improbable, as it appears too near the Fort.

There appears to be no definite evidence at all of any local elevation of the region during the Recent, and probably also, during the Pleistocene times, while as already stated, there seems to be some evidence to indicate a gradual and very slow submergence of the whole area under consideration and the amount of submergence appears to be greater in S. E. portion of the district.

North of Madras City, the coastal alluvium narrows till the eastern limits of the lateritic formation of the Red Hills, but widens further northward joining with the fluviatile alluvia of the Korttalaiyar, the Old Palar, and the Arani rivers. North of the Arani, it again narrows, so that south of the Pulicat lake, it is approximately six miles, and S. W. of the same lake it dwindles greatly in breadth, being only about two miles. Here also, there appears to be no definite evidence of upheaval, and the probability is that the land has submerged to some extent, though the amount may not be so great as in the S.E. part of the area under consideration.

SUB-AERIAL SAND DEPOSITS

Sand deposits in the form of sand dunes or hillocks occur all along the coast. South of Madras, there is a continuous stretch of such hillocks from about 2½ miles south of Covelong up to 2 or 3 miles south of Mahabalipuram. Still further south, they are seen in the form of elongated detached dunes parallel to the coast starting from near Kanattur about 1½ miles south of the mouth of the Palar, and extending to Kaliveli tank and beyond. The height varies usually from 25 to 30 feet, while frequently they may be 40 to 50 feet and occasionally, 60 feet or even slightly more.[81] At Covelong, they appear to cover old ruined buildings and at Mahabalipuram they may be seen advancing towards the monolithic temples; near the former place, an inland dune may be seen west of the backwater. Small dunes of about 8′ or 10′ high also occur near Madras in the Elliot Beach, and one within the City just north of the University Examination Hall, and west of the Beach Road, forming the fishermen colony. Speaking generally the size of the dunes appears to decrease as one proceeds from the south to the north of the district so that north of Madras, though wide stretches of sand may be seen, high dunes are rare. At Ennore some small ones occur making an inroad on small temples and ruined buildings.

81. *E.g. East of Yadayanthittu Kaliveli, where sand dunes of more than 65 feet are to be seen.*

But the highest ones reaching between 40′—50′ appear at Sinthamanipuram. North of this place, till the Pulicat light-house, the dunes are not important; but three miles north of Coromandel, at the village Thoppalampalaiyam they become of some importance and attain heights upto 30 feet. At Pungulam about eleven miles north-west of Pulicat, it forms a hillock, which is interesting in that the sand is reddish in colour probably due to the action of the S. W. monsoon carrying red lateritic dust north-eastward, and not due to the N. E. monsoon for the Pulicat lake is situated north-east of it.

Except at places where rivers and backwaters join the sea, the whole coast is a vast stretch of sands, forming probably one of the magnificent beaches in the world. Frequently, the mouths of rivers also get blocked by sandbars formed across the mouths, chiefly due to the action of the breakers. This may be seen beautifully at the mouth of the Cooum in Madras, and the bar has to be broken annually during the north-east monsoon to permit a free flow of water, and to prevent a flooding of the low level regions of the city. Here the deposition of sand appears to be the result of the building of the Madras Harbour which impedes the coastal currents, thus making a beautiful and fine beach for Madras.[82]

The prevention of the sand dunes from migrating and covering the surrounding cultivated fields and inhabited regions is an interesting problem. This has been fairly successfully tackled by the growth of various hardy rather xerophytic plants, which bind the sand either by the roots, or by the roots and runners as: *Launea pinnatifida, Anacardium occidentale, Pandanus, Spinifex squarrosus, Ipomea biloba, Cyperus anenarius, Hydrophyllax maritima, Borassus flabellifer* and *Casuarina-equisetifolia,* which thrive well in such an ecological environment. The last tree is so important economically in that it forms the chief fuel for the people of Madras, that large and thriving plantations may be seen over wide regions all along the coast.

SOILS

Though soils bear a very close relationship to the underlying geological formations, they appear to have been moved about to such a great extent, mostly as the result of rather sudden and

82. *Vide,* references given elsewhere in the paper.

torrential rainfalls during the N. E. monsoon and frequent cyclones, that they have been sorted out to some extent, presenting the appearance of sedimentary formations in exhibiting a rough stratification. These, no doubt, link the truly sedimentary deposits with the truly sub-aerial deposits to be found so widely distributed superficially in the area.

Generally speaking the soil of the district is poor and sandy with a general tinge of red or yellow colour. The *purely sandy soil* is mostly confined to the coastal alluvium, and this improves with age, and hence, with distance from the shore, where it becomes red ferruginous and loamy by intermixture with clay ; the Poonamallee and the immediately surrounding parts are probably the best example for this ; and the coastal alluvium here enters inland in the form of a small bay extending as far as Sittukkadu and Tirumahishai, bounded on the south and south-east by the gneissic area, and on the other sides either by the older or younger river alluvium. The same is true of a good portion of the soil of the Saidapet Taluk, which possesses a fairly good soil except in places, where it becomes alkaline (e.g., along the southern branch of the Adyar river), or saline (e.g., near the coastal lagoons). Nearer the coast, the coastal alluvium is so sandy as to be practically useless for the growth of any vegetation except *Launea pinnatifida, Annacardium occidentale, Pandanus, Spinfex squarrosus, Ipomea biloba, Cyperus anenarius, Hydrophyllax maritina, Borassus flabellifer, Cocos nucifera* and *Casuarina equisetifolia*; all these plants not only help to bind the sand, but also increase the humic content of the poor soil, thus functioning as the first colonisers of the plant kingdom; in addition, the last plant enriches the soil in nitrogenous material, as the result of the activity of nitrifying bacteria in its root-nodules. Frequently, the coastal sandy area becomes excellently suited for the cultivation of cocoanut topes; though cocoanut trees are to be seen right along the coastal belt, special mention must be made of the S. E. portion of the Madurantakam taluk, separated from the mainland by a depression, called Yedakainadu or left-hand land, where the best cocoanuts of the area grow ; they find an easy and ready market in the district itself. A little further inland the region is so saline, that even these plants find it difficult to grow; such areas, frequently including salt swamps, have to a large extent been utilised for the manufacture of common salt. In addition to common salt a large number of minerals which are the result of desiccation of inland coastal lagoons have been reported as fibrous gypsum, selenite, carbonate of soda, fuller's

earth, and lime.[83] Here, the soil is so poor and the general appearance so desolate that the belt has been compared to the region around the Dead Sea. The *soils covering the Older Alluvium* are either quartzitic gravelly and mixed with Soda, lime and relatively free from ferruginous matter, or lateritic, which may be gravelly, gritty or sandy. These soils are generally speaking much inferior to the loamy soils to be described below. The first type is to be seen largely in the Conjeeveram taluk, covering the high ground in the north, north-east and north-west of the town in the form of an elongated patch east to west, weathered from the Conjeeveram gravel and the latter in the Tiruvallur taluk. Though the Tiruvallur taluk receives the greatest amount of rainfall in the district, being about 60″ on the average, yet on account of the poor nature of the soil, it is no better off than regions, which receive half its rainfall, but contain rich black soil; but the taluk contains a good portion of the wooded areas of the district; this is probably more due to the rainfall, than to soil richness. A good portion of the district is covered by *recent alluvium* consisting of dusty loamy soil to gritty or rarely gravelly soil deposited by the rivers Palar and its tributaries along their course: a still wider band may be traced along the Old Palar river or Vridhakshiranadi starting from about ten miles east of Arcot following the Place's canal, to between Tiruvallur and Neyveli. till it reaches the Korttalaiyar and the Arani or the Narayanavaram alluvia, and following their course to almost their present embouchures; one band is also recognised north of Conjeeveram starting about two miles east of the first place and joining with the Palar alluvium near Walajabad; and they are also seen along the courses of the Korttalaiyar, the Arani, the Cheyar, and to a less extent in the valleys of smaller streams; it is quite likely the mouth of the Old Palar would have been situated further inland, and also slightly north of the present embouchure of the Korttalaiyar with an extensive lagoon or breakwater. The *Old Palar alluvial soil* is mostly gravelly and gritty, while the *Palar soil* is either gritty or finer sand of reddish colour, frequently passing into loam or greyish black or black clay; the last formation is confined mostly to its banks near its mouth east of Chingleput.

The wide gneissic area about 16 miles wide and 26 miles in length occupying practically the whole of the S.E. of the district,

83. Ten years correspondence on the Resources of India with reference to Mr. Greenough's Map of India, pp. 38-51.

between the coastal alluvium of the coast and Poonamallee, the Old River alluvium on the west, and the Palar alluvium on the south, is mostly stony and rocky, except in the depressions, which are made up of smaller angular or subangular pebbles, grits, sands and clays washed down from the round, protruding, detached, rocky masses barren of vegetation, or covered with a thin scrub jungle. Hence, in these depressions the thickness of the soil cover is by no means uniform, and where the depression is extensive as well as fairly deep, there has been relatively greater chance for the underground water as well as surface run-off to stagnate, thus forming relatively fertile areas: the capacity to hold water in such depressions, has been increased frequently, by bunding up the lower sides, thus forming lakes or big tanks (eg. the Chingleput lake): sometimes, as the result of diversion of streams, or cutting channels to bigger rivers, the water capacity is still more augmented (e.g. the Madurantakam tank). Hence, the red loamy soil of this region is fairly fertile, and is superior to the soils of the other regions of the district. Tanks and lakes, most of them artificial, are very abundant in the district, and they form excellent places for the accumulation of fine silt and clay not only of the surrounding area, but also of distant parts, as they are frequently connected to rivers or to flood canals of rivers; thus, in tank beds one finds black or gray clay rich in humus.

ECONOMIC ASPECTS

Underground water resources.

The following observations may be helpful in giving some idea of the underground water resources of the region. In the Madras—Poonamallee bay,[84] water is likely to be met with at very shallow depths from about 10 feet up to about 58 feet, at which approximate depth gneissic rock is likely to be struck. The water may or may not be fresh, as the region appears to have been occupied by a salt water lake (probably in many respects similar to the Pulicat lake), which appears to have been evaporated to dryness in places. On account of the shallowness of the sources of water, and the great porosity of the sandy soil of the upper levels, the water is likely to get easily impure and infected by surface infiltra-

84. *Vide* W. King Rec. G.S.I., Vol. XIII, pt. 2, pp. 115, 136—138, and other references given elsewhere in the paper regarding well-sections in Madras.

tion.[85] The available amount also may not be large, considering the irregular nature of the distribution of the porous strata, and the quality and the degree of purity cannot be uniform over long periods. Besides, in good many places the water is likely to be brackish. The rate of flow, to fill a large depleted well with a diameter of 20 feet, was found to be approximately 3 feet in 24 hours.

The coastal alluvial regions, on account of their sandy nature, frequently contain excellent water stored up. These may form important sources of good water, provided the demand is not great and, for the reasons pointed out above, it is tapped with caution. The sandy areas north of Madras including the Seven Wells, and the ancient fort Alamparai (Alumparva) in the southernmost boundary of the district are historic examples.

In the regions south of Madras occupied by the gneisses and gneissic granites, there is not much hope of finding important sources of water, except to some extent in the surface altered portion of the rock. However, in low-level areas in the form of small basins between the hillocks, where thicker accumulation of such weathered material is possible, there is a good chance of finding larger and more permanent supply of water.[86] A careful geological study of the region will be necessary before such basins can be made out. Anyhow, the available amount of water may not be sufficient to supply towns, and may be doubtfully sufficient for large cantonments.[87] The river or drainage channel beds are likely to afford a good supply of water, if wells are sunk in them; but they ought to be protected from the percolation of surface impurities. A fairly good supply of fresh water is likely to be

85. Cf. "Fears were also entertained about the quality of the Seven Wells water and a report made by Mr. Meyer and Dr. Wyndow, who had been appointed to analyse the water of the Wells said that the smallest amount of impurity found was double that which the authorities at home considered possible and that the natural and only sound inference from the conditions of the soil was that it would be necessary for Government to look for water beyond this polluted area (the area of the Wells)"—V. D. Krishnaswami, Mad. Tercentenary Commemmoration Volume, p. 288.

86. It is also likely, as these areas are usually converted into tanks by damming up that portion where the basin is open, there will be a good accumulation of under-ground water, so as to say, to form under-ground tanks to be utilised in the dry season, when the tank above becomes dry.

87. General Report of G.S.I., for 1936, pp. 46 & 47.

got from sinking wells in the prominent faults or fissures and joints in rocks. Here again, a good and careful geological study must be conducted before the faults may be recognised.

The regions occupied by river alluvia in the map form excellent places for getting a large and good supply of water, especially the valleys of the Old Palar, the Korttalaiyar and the Arani rivers. As the coarse to fine sandy or gritty beds are underlaid by conglomerates of slightly older age, the latter also form important reservoirs of underground water, because the bed underlying them appear to be a shaly one of Sriperumbudur age, which is impervious. The lower beds underlying the shales do not appear to possess any important water bearing stratum; for a boring at Ennore sunk in 1883 to penetrate into these rocks struck only a poorly water-bearing stratum at about 213 feet below the surface.[88]

The areas occupied by the Satyavedu sandstone stage, as the Satyavedu region, the Allikkuli region, the Palayanuru region and the isolated outliers of Jurassic age south of the Palar, as those to be found near Uttarametur, around Padiri and around Velangadu are also areas, where a fairly good supply of fresh water is available at very shallow depths of 15 to 20 feet; but a greater depth will undoubtedly be necessary to ensure a perennial supply.

Economic Minerals.

The economic resources of the region under review are not very great. Building stones form the most important economic material of the area; and they consist of the biotite or hornblende gneisses, the Charnockites, the laterites and the Satyavedu sandstone. The hornblende gneiss is quarried in the gneissic regions at various places, as near Walajabad etc. The Charnockites are extensively quarried near Pallavaram not only as building stone, but also as road and railroad metal; they are used as curry-stones, pounding-stones or mortars, road rollers etc; the basic Charnockites form very good ornamental stones in building, as they take an excellent and beautiful black polish looking like black marble but infinitely more durable and the polish more enduring; hence, they are used as tomb and ornamental stones. Compact laterite of the Red Hills region and the areas further westward and those between the Korttalaiyar and the Arani rivers form also good

88. Mem. G.S.I., Vol. XXXII, pt. I, 1901, p. 51.

building stones; they have been used in these places for temples, tank-bunds, tank-weirs, railway stations, Choultries etc. Gravelly or friable laterite is widely used as a road-metal either alone or mixed with the gneissic or Charnockite pieces; in the latter case, it forms a good cementing material. Satyavedu sandstone also is widely excavated; on account of its easy workability it forms a good building and ornamental stone; the reddish or yellowish red colour with an imperfect stratification gives it a rather pleasing appearance; it is cut out near Satyavedu, Nagalapuram, Conjeeveram etc.

Near the coast, as the result of desiccation of backwaters some surface salt deposits are economically important: salt also occurs in the form of bitter brine, which is made use of in the manufacture of common salt: extensive salt pans may be seen in several places as near Ennore, Pulicat, Covelong etc. Thin beds of gypsum, and rarely Selenite have been recorded with shale beds in the digging of wells in the coastal regions.

Sriperumbudur shale beds form a very important pure deposit of clay near Madras, suitable for the manufacture of good porcelain ware; but plenty of clear, fresh water, which is difficult to obtain in the area, will be required for its exploitation

Sandy clay is very widely used for brick manufacture near Madras as in Chetpet, Nerkunram etc.; and fine sand is also available in good quantities for mixing with chunam and cement. Plenty of lamellibranch shells are obtained in the Pulicat lake and along the coastal parts south of Madras pits are dug to obtain them.

APPENDIX

LIST OF PLACE NAMES WITH THEIR LOCATION IN THE ONE INCH SURVEY OF INDIA MAPS.

NOTE :—Latitudes are all north ; longitudes are east of Greenwich.

The spelling, as far as possible, strictly conforms to that of the One Inch Maps of the Survey of India ; the names given in brackets refer to those used either in the Indian Atlas Sheet 78, or in the description of R B Foote (or other earlier workers) or in both as equivalents.

Acharapakkam hill	12°	23′	0″	79°	47′	23″
Agaram hill	12°	45′	23″	80°	6′	7″
Akkampuram (Ackeramperam, Ackerum-perum)	12°	58′	27″	79°	46′	0″
Alagusamudram hill.	12°	38′	23″	80°	1′	13″
Alamparai (Alumparva, Alamparva)	12°	16′	0″	80°	0′	47″
Alappakkam hill	12°	40′	15″	80°	0′	10″
Allikkuli peak	13°	17′	0″	79°	43′	57″
Allikkuli village (Alicoer, Alicoor)	13°	15′	54″	79°	47′	6″
Amarambedu (Amanumbaid, Amerumbode)	12°	57′	54″	80°	1′	0″
Amarambedu (Amerumbardoo, Amerambode)	13°	23′	53″	80°	0′	40″
Ambakkam peak	13°	22′	10″	79°	52′	43″
Ammanampakkam hill	12°	49′	0″	80°	7′	20″
Anakaputtur (Anacotore, Anakaputur)	12°	58′	47″	80°	7′	43″
Angur hill	12	42′	53″	80°	2′	44″
Appur hill	12°	48′	10″	79°	59′	10″
Arambakkam	12°	52′	0″	80°	0′	40″
Araneri	12°	55′	23″	79°	55′	0″
Arani village	13°	19′	53″	80°	5′	13″
Arcot	12°	54′	0″	79°	19′	40″
Ariyattur	13°	5′	53″	79°	53′	10″
Ariyavakkam (Arryapaucum)	12°	58′	57″	79°	50′	30″
Arkonam (Arconum, Aricoonum)	13°	4′	40″	79°	40′	10″
Arudur	13°	34′	37″	79°	56′	40″
Arumbakkam	13°	12′	0″	79°	51′	25″
Arunkunnam	12°	43′	50″	79°	52′	0″
Attan tangal	13°	12′	14″	80°	10′	5″
Attipattu (Oxapet, Attiput)	13°	10′	10″	79°	46′	33″
Attirambakkam (Attrampakkum)	13°	13′	50″	79°	53′	20″
Avadi (Avady, Aoady)	13°	7′	0″	80°	6′	10″
Avalur (Outtoor, Onatoor)	12°	53′	30″	79°	32′	40″
Avirmedu hill	12°	27′	13″	79°	54′	45″
Ayanabakkam	13°	4′	40″	80°	9′	7″
Ayyapakkam (Ayappalicum, Ayapakkam)	13°	5′	40″	80°	8′	0″

Baleswaram	12°	39′	47″	79°	50′	53″
Birakuppam	13°	27′	20″	79°	50′	50″
Bezwada	16°	31′	26″	80°	36′	15″
Budavada	15°	51′	0″	80°	12′	0″
Budur (Boodoor)	13°	25′	0″	79°	57′	40″
Chetpet	13°	4′	10″	80°	14′	0″
Cheyur	12°	21′	0″	80°	0′	23″
Cheyyar	12°	39′	24″	79°	32′	40″
Chinna Tripetty	16°	59′	0″	81°	20′	0″
Chingleput	12°	41′	33″	79°	58′	33″
Chintamani	13°	24′	14″	78°	3′	24″
Chunampet	12°	15′	13″	79°	54′	40″
Conjeeyeram (Conjeveram)	12°	50′	0″	79°	42′	0″
Coromandel	*13°*	*27′*	*13″*	*80°*	*18′*	*20″*
Covelong	12°	47′	7″	80°	15′	0″
Damal (Damul)	12°	53′	10″	79°	35′	40″
Damarappakkam	13°	12′	50″	80°	1′	40″
Devariyambakkam (Devaroyempakkam)	12°	49′	0″	79°	52′	27″
Dugarazpatnam	13°	58′	30″	80°	10′	0″
Dusi (Doshee)	12°	46′	30″	79°	40′	47″
Edaiyur	12°	34′	10″	80°	10′	53″
Edakunram	12°	41′	18″	80°	6′	10″
Edamich hill	12°	41′	30″	79°	51′	53″
Edayarpalaiyam	13°	10′	47″	80°	16′	27″
Ennore	13°	14′	50″	80°	19′	40″
Erumaivettipalayam (Yermootapolliam)	13°	14′	20″	80°	7′	23″
Erumaiyur hill	12°	57′	13″	80°	4′	33″
Ganjam	19°	23′	30″	85°	3′	0″
Golapalle	16°	43′	0″	80°	58′	0″
Gudiyattam	12°	50′	20″	78°	52′	20″
Guduvancheri hill	12°	49′	50″	80°	3′	43″
Guduvancheri village	12°	50′	47″	80°	3′	47″
Gunipalaiyam (Goompollium, Goompolliam)	13°	17′	0″	79°	51′	14″
Hadsanpuram (*Hodson's Pettah*)	13°	17′	0″	79°	46′	25″
Hanumantaputter hill	12°	40′	40″	79°	58′	3″
Harichchandrapuram (*Catramatoor*)	13°	5′	9″	79°	44′	37″
Illatturu (Illatoor)	13°	14′	50″	79°	41′	27″
Illuppattandalam (Illeputundlum, Illeputandalum)	13°	1′	0″	79°	40′	0″
Injambakkam (Ingepaucum, Ingepaukum)	12°	53′	40″	79°	41′	40″
Irumbedu (Yerremboor)	12°	57′	0″	80°	0′	17″
Irungattukottai	12°	50′	37″	79°	58′	30″
Isur	12°	32′	23″	79°	59′	57″

Kachchur (Cutchoor) ..	13°	17′	27″	79°	53′	37″
Kadumbattur ..	13°	5′	50″	79°	51′	50″
Kalahasti ..	13°	45′	0″	79°	42′	0″
Kalattur ..	13°	48′	42″	79°	57′	7″
Kalivambakkam (Cullumbaucum)	13°	19′	40″	79°	43′	28″
Kallikuppam (Callicoopum) ..	13°	12′	23″	80°	5′	15″
Kalway hill ..	12°	46′	23″	80°	6′	50″
Kambakkam Durgam ..	13°	34′	27″	79°	51′	40″
Kanattur ..	12°	26′	0″	80°	7′	33″
Kandalur hill ..	12°	43′	23″	79°	58′	47″
Kandur (Candoor, Kandoor) ..	12°	56′	54″	79°	50′	7″
Kanjampattu (Kinjamut. Kinjamuttoor) ..	13°	9′	20″	79°	42′	20″
Kanjipadi (Conjibuddy) ..	13°	12′	43″	79°	47′	13″
Kannammapettai ..	13°	11′	50″	79°	53′	10″
Kannambakkam (Cunnumpacum, Cunnumbaucum) ..	13°	29′	33″	80°	2′	0″
Kannankaranai ..	13°	9′	27″	79°	51′	20″
Kannavaram (Carnaveram) ..	13°	26′	5″	79°	52′	33″
Karadiputtur (Caradecootoor. Caradepootoor) ..	13°	21′	47″	79°	58′	3″
Karai (Corree) ..	12°	52′	53″	79°	43′	30″
Karaikalani hill ..	12°	48′	40″	80°	3′	14″
Karunguli hill ..	12°	32′	10″	79°	53′	27″
Kaveripauk (Cavrepauk) ..	12°	54′	27″	79°	27′	50″
Kaverirajapuram (Cavitporam, Cavitpooram. Kavedupooram) ..	13°	10′	0″	79°	45′	0″
Kattanur ..	13°	11′	43″	79°	50′	53″
Kattupalli ..	13°	18′	17″	80°	19′	53″
Kattur hill ..	12°	42′	35″	80°	7′	5″
Kilacheri (Reesary, Keesary) ..	13°	1′	30″	79°	51′	6″
Kiranallur (Keremulloor, Kiranullur) ..	12°	55′	30″	79°	49′	54″
Kokkarantangal ..	12°	20′	3″	79°	55′	30″
Kolandalur ..	13°	10′	0″	79°	52′	30″
Kollanur (Colanur) ..	13°	22′	20″	80°	1′	5″
Kondapuram ..	12°	54′	7″	79°	28′	0″
Koppedu ..	13°	24′	27″	79°	42′	13″
Koppur (Coopore, Coopoor) ..	13°	4′	23″	79°	58′	0″
Korattur ..	13°	4′	27″	80°	1′	8″
Kosalnagaram (Naikenpolliam, Nakinpollium) ..	13°	14′	40″	79°	43′	40″
Krishnapatnam ..	14°	17′	5″	80°	7′	30″
Krishnapuram (Kistnahporam, Chittapuram) ..	13°	10′	30″	79°	50′	0″
Kuchimalai ..	12°	21′	30″	79°	53′	18″
Kumili hill ..	12°	48′	0″	80°	6′	50″
Kunjaram (Cunjalum) ..	13°	15′	33″	79°	53′	7″
Kunnattur ..	12°	59′	10″	80°	5′	43″
Kunnavakkam hill (in Chingleput taluq) ..	12°	42′	23″	80°	1′	7″
Kunnavakkam hill (in Conjeevaram taluq) ..	12°	50′	50″	79°	54′	5″
Kunnavakkam village ..	12°	40′	0″	79°	49′	20″

Kuppam ..	13°	6'	20"	79°	54'	30"
Kuttambakkam ..	13°	3'	33"	80°	1'	40"
Kuttarambakkam (Cotrumbaucum) ..	12°	53'	52"	79°	45'	34"
Madarpakkam (Maderapaucum) ..	13°	26'	47"	80	0'	20"
Madurantakam town ..	12°	30'	33"	79°	53'	20"
Mahabalipuram ..	12°	37'	0"	80	11'	40"
Mailai hill ..	12°	42'	35"	80	7'	5"
Malaipattu hill ..	12°	54'	53"	80	0'	50"
Mallareddikhandrika (Mullyreddypolliam, Mallareddypolliam) ..	13°	14'	20"	79	46'	40"
Mamandur (Maundoor) ..	12°	52'	43"	79°	30'	30"
Mamandur (Maumdoor) ..	12	45'	10"	79	40'	40"
Mambudur ..	12°	40'	10"	79	51'	6"
Mangadu ..	13	0'	20"	80	6'	0"
Mangillmalai ..	12°	22'	30"	79°	52'	55"
Manjankaranai ..	13°	16'	15"	80	7'	0"
Manuru ..	13	5'	33"	79°	48'	13"
Markkanam ..	12°	11'	30"	79°	56'	42"
Melagaram ..	13°	10'	10"	79°	51'	36"
Melaivaiyavur ..	12°	35'	43"	79°	53'	35"
Melvasalai ..	12°	22'	20"	79	55'	44"
Mettupalaiyam (Motopullum, Molopullum, Mettapaluyam) ..	12°	52'	0"	79	55'	0"
Meyyur (Myoor) ..	13°	14'	27"	79	56'	40"
Minjur ..	13	16'	40"	80°	15'	33"
Mittanemali (Mittanemalei, Metnavilly) ..	13°	9'	17"	80°	4'	13"
Mosur (Moshoor) ..	13°	5'	0"	79°	43'	13"
Mullumalai ..	12°	56'	53"	80°	6'	47"
Muppantalmalai ..	12°	23'	40"	79°	54'	10"
Nagalapuram peak ..	13°	26'	23"	79°	46'	40"
Nagalapuram village ..	13°	23'	10"	79°	47'	47"
Nagari peak ..	13°	22'	47"	79°	35'	47"
Nagari village ..	13°	19'	20"	79°	35'	15"
Nallambakkam ..	12°	50'	33"	80°	7'	13"
Nallur (Bootundalum) ..	12°	57'	23"	80°	2'	0"
Nambakkam ..	13°	14'	10"	79°	51'	23"
Nanmangalam hill ..	12°	55'	30"	80°	10'	38"
Naravarikuppam (Narraincoopum) ..	13°	11'	17"	80°	11'	15"
Narayanavanam village ..	13°	25'	30"	79°	35'	27"
Nedugunram hill ..	12°	52'	50"	80°	6'	30"
Nedungal ..	12°	20'	47"	79°	44'	55"
Nelvay ..	12°	36'	53"	79°	49'	27"
Nelvay (Nelway) ..	13°	15'	27"	79°	52'	12"
Nemam ..	13°	4'	0"	80°	1'	13"
Nemmali hill ..	12°	40'	3"	80°	1'	44"
Nemmali village ..	13°	0'	10"	79°	55'	23"
Nerkunram ..	13°	4'	0"	80°	11'	10"
Nerumbur ..	12°	31'	10"	80°	4'	7"
Neyveli (Nemaly) ..	13°	12'	30"	79°	54'	0"

Odappai (Odapei, Odipee)	..	13°	13′	47″	79°	54′	0″
Olakkur	..	12°	18′	43″	79°	43′	5″
Ongur	..	12°	19′	33″	79°	46′	47″
Oragadam hill	..	12°	38′	0″	80	3′	57″
Oragadam village (Woodagurm, Oragidam)	..	12°	50′	30″	79°	56′	54″
Oratti hill	..	12°	22′	37″	79°	40′	42″
Orattur	..	12°	28′	43″	79	47′	53″
Orattur (Ooratoor)	..	12°	50′	57″	80°	1′	3″
Ottiyambakkam hill	..	*12°*	*51′*	*33″*	*80°*	*11′*	*22″*
Pachaimalai	..	12	56′	37″	80°	7′	38″
Padiri	..	12°	29′	10″	79°	46′	15″
Padur	..	13	3′	0″	80°	0′	36″
Pagalmedu	..	13°	14′	7″	80°	1′	27″
Palanjur (Panjur)	..	13°	1′	10″	80°	2′	27″
Palaveri	..	12	44′	13″	79°	52′	55″
Palayanuru (Pyanoor)	..	13°	7′	20″	79°	47′	17″
Pallavaram hill	..	12°	58′	10″	80°	9′	45″
Palur	..	12°	57′	43″	79°	40′	15″
Pammal	..	12°	58′	30″	80°	8′	10″
Pandur	..	13°	32′	53″	79°	55′	30″
Pandur	..	13	9′	25″	79°	51′	0″
Parandur (Parundoor)	..	12°	56′	33″	79°	44′	20″
Pavulur	..	15°	51′	0″	80°	14′	0″
Pedda Ganjam	..	15°	38′	30″	80°	13′	47″
Pennalurupet (Benaloor)	..	13°	18′	24″	79°	51′	20″
Peripuliyur (Pulloor)	..	13°	23′	20″	80°	2′	10″
Perumallapatti (Perumalpett, Permaulnaigput)	..	13°	6′	33″	79°	59′	37″
Perumbedu	..	13°	21′	27″	13°	14′	40″
Perumberkandigal hill (Perumber hill)	..	12°	23′	0″	79°	47′	23″
Perumberkandigal village (Perumber village)	..	12°	22′	40″	79°	46′	47″
Perunagar	..	12°	38′	50″	79°	39′	37″
Peruvali	..	12°	25′	47″	79°	54′	55″
Pinjivakkam	..	13°	4′	37″	79°	51′	50″
Pondavakkam (Paundawaucum, Paundavaucum)	..	13°	28′	20″	79°	59′	47″
Poonamallec (Poondamallee)	..	13°	2′	40″	80°	6′	47″
Porundavakkam hill	..	12°	40′	33″	80°	2′	33″
Porur	..	12°	21′	0″	79°	54′	40″
Pravalavaraneswarapuram	..	13°	30′	0″	79°	53′	5″
Pudukuppam	..	13°	21′	10″	79°	54′	43″
Pudupper (Poothoopare, Puduperu)	..	12°	58′	54″	80°	3′	0″
Pulicat village	..	13°	24′	53″	80°	19′	3″
Puliyur (Pilyur, Pilwoor)	..	13°	9′	17″	80°	1′	0″
Pundi	..	13°	12′	40″	79°	52′	45″
Pungulum	..	13°	29′	10″	80°	11′	7″
Raghavapuram	..	12°	52′	23″	79°	46′	17″
Rajukulum (Rajah's Choultry)	..	17°	2′	0″	81°	29′	0″

Ramagirimalai ..	13°	25′	40″	79°	45′	20″
Ramamalai ..	12°	44′	13″	80°	5′	10″
Ramanjeri ..	13°	12′	0″	79°	47′	40″
Rangapuram ..	13°	13′	7″	79°	52′	7″
Sadras ..	12°	31′	27″	80°	9′	47″
Saidapet ..	13°	1′	20″	80°	13′	23″
Saint Thomas Mount ..	13°	0′	13″	80°	11′	40″
Saint Thomé ..	13°	2′	0″	80°	16′	40″
Salavadu ..	12°	28′	40″	79°	43′	53″
Santhakuppam hill .	12°	42′	50″	80°	4′	10″
Sattamai hill ..	12°	33′	38″	79°	54′	13″
Sattarai (Suttry, Settorei) ..	13°	3′	10″	79°	51′	0″
Satyavedu village (Sattavedu, Sattavade) ..	13°	26′	7″	79°	57′	30″
Satyavedu peak ..	13°	28′	7″	79°	53′	43″
Sedulapakkam (Callapanidoopettah, Callapanaidoopettah) ..	13°	26′	53″	79°	58′	40″
Sembedu (Chumbode) ..	13°	14′	13″	79°	59′	40″
Senjiagaram (Chingeagrin, Sinjeagraram) ..	13°	19′	40″	79°	56′	23″
Settipuniyam hill ..	12°	44′	53″	79°	59′	0″
Seven Pagodas ..	12°	37′	0″	80°	11′	40″
Simapuram ..	13°	15′	36″	80°	15′	13″
Singalpadi (Singilpadi) ..	12°	55′	10″	79°	47′	40″
Sinthamanipuram ..	13°	21′	20″	80°	20′	16″
Siruperpandi ..	12°	23′	17″	79°	45′	40″
Siruvadu (Seerwaydoo, Seervedu) ..	13°	23′	43″	79°	59′	45″
Siruvakkam (Surebaucum) ..	12°	54′	47″	79°	42′	53″
Sitenjeri ..	13°	16′	43″	79°	53′	30″
Sittalapakkam hill (in Saidapet taluq) ..	12°	53′	3″	80°	11′	43″
Sittalapakkam hill (in Madurantakam taluq) ..	12°	43′	47″	79°	51′	6″
Sittukkadu (Chittagauda) ..	13°	5′	20″	80°	3′	0″
Sriharipuram (Woterpolliam) ..	13°	13′	53″	79°	46′	3″
Sriperumbudur town (Sripermatoor, Streepermatoor) ..	12°	58′	0″	79°	57′	0″
Sulurpet ..	13°	41′	50″	80°	1′	7″
Surikapuram (Suroperam) ..	13°	17′	23″	79°	42′	43″
Surutapalli (Sirgulpilly) ..	13°	20′	0″	79°	52′	33″
Takkolam village (Tukkool, Tukkolum, Tukkoolum) ..	13°	1′	0″	79°	44′	0″
Talambedu hill ..	12°	36′	53″	80°	2′	13″
Tamarakuppam (Junglepilly) ..	13°	20′	50″	79°	55′	33″
Tambaram hill ..	12°	56′	8″	80°	6′	27″
Tambaram village ..	12°	55′	27″	80°	6′	17″
Thatharmalai ..	12°	21′	30″	79°	53′	18″
Thirupper ..	13°	12′	36″	79°	50′	15″
Thiruvalambudur ..	13°	11′	23″	79°	52′	4″
Thomas Mount ..	13°	0′	13″	80°	11′	40″
Thoppalampalaiyam ..	13°	29′	17″	80°	17′	33″

Tinnanur (Tinnanore, Tinanoor), Railway Station ..	13°	7′	20″	80°	1′	47″
Tinnanur village ..	13°	6′	45″	80°	1′	40″
Tirukkachchiyur hill ..	12°	46′	27″	79°	59′	37″
Tirukkalikkunram hill ..	12°	36′	37″	80°	3′	38″
Tirukkalikkunram village ..	12°	36′	20″	80°	3′	30″
Tirumahishai (Trimalchy) ..	13°	3′	0″	80°	3′	33″
Tirumakkudal ..	12°	45′	23″	79°	51′	40″
Tirumallivayal (Tirumullavayal, Trimullavoil) ..	13°	8′	7″	80°	8′	0″
Tirumangalam (Tremungalum, Tirumungalum) ..	12°	55′	54″	79°	53′	23″
Tirumani hill ..	12°	39′	3″	79°	58′	47″
Tiruninmalai ..	12°	57′	47″	80°	6′	57″
Tiruppachur (Tripassore) ..	13°	8′	17″	79°	52′	40″
Tiruppandiyur (Punnoor) ..	12°	57′	33″	79°	52′	47″
Tiruttani (Tirutany) ..	13°	10′	30″	79°	37′	0″
Tiruvallur (Trivellore) Railway Station ..	13°	7′	0″	79°	54′	50″
Tiruvallur town ..	13°	8′	37″	79°	54′	27″
Tiruvelangadu Railway station (Chinnamapett station, Chinamapett Station) ..	13°	5′	20″	79°	46′	0″
Tiruvelangadu village (Trevalangall, Trevalankadu, Trevatangul) ..	13°	7′	47″	79°	46′	40″
Tiruverkadu ..	13°	4′	13″	80°	7′	0″
Tiruvottiyur ..	13°	9′	33″	80°	18′	7″
Todukkadu (Todocaud, Todukadu) ..	12°	59′	37″	79°	56′	6″
Toidavuru (Tydoor, Tyloor) ..	13°	5′	27″	79°	46′	27″
Tomur (Toombul, Tumbool) ..	13°	12′	15″	79°	48′	15″
Tonnadumalai ..	12°	23′	40″	79°	54′	10″
Tripetty (Chinnatripetty) ..	16°	59′	0″	81°	20′	0″
Tripurantakapuram (Tipporandaporum) ..	13°	27′	33″	79°	51′	43″
Umaiyaparanachcheri (Omeallicherry) ..	12°	50′	0″	79°	58′	33″
Umaiyapuram (Umaiverum, Umayapuram) ..	12°	49′	13″	79°	35′	30″
Unamanjeri hill ..	12°	51′	10″	80°	7′	53″
Uriyur (Waroor, Warroor) ..	13°	2′	47″	79°	46′	27″
Utatur ..	11°	4′	0″	78°	55′	0″
Uttaramerur ..	12°	36′	50″	79°	45′	40″
Vadamadurai (Waramderry, Vadamadiri) ..	13°	17′	5″	80°	2′	30″
Vaiyapur (Vippoor, Vippur) ..	12°	52′	23″	79°	58′	0″
Vallakottai (Valleycottah, Vellakotta) ..	12°	53′	0″	79°	56′	10″
Vallam hill ..	12°	41′	30″	80°	1′	22″
Vallum (Vellum) ..	12°	53′	40″	79°	56′	6″
Vallur ..	13°	15′	20″	80°	17′	0″
Vandalur hill ..	12°	53′	47″	80°	5′	48″
Vanjivanjeri (Vanjeri) ..	12°	52′	31″	79°	50′	49″
Varadayyapalaiyam ..	13°	35′	53″	79°	58′	0″
Vattambakkam (Vautambaucum) ..	12°	50′	28″	79°	58′	23″
Vayalanallur ..	13°	5′	7″	80°	4′	24″

Vedal (Vidaloor)	12°	52'	47"	79°	45'	0"
Vegamangalam, (Mavamanglum, Maramungalum, Mavamunglum)	12	52'	40"	79	29'	30"
Velangadu	12°	24'	35"	79°	46'	7"
Vellarai (Vallerry, Vellarei)	12°	55'	20"	79°	59'	20"
Velliyur	13°	13'	0"	80°	0'	40"
Vemavaram	15°	41'	0"	80°	13'	0"
Vembedu malai	12°	44'	40"	80°	8'	10"
Vengal (Vungul, Vingul)	13°	15'	0"	80°	0'	50"
Venkatapuram hill	12°	45'	47"	79°	58'	25"
Venpakkam hill	12°	46'	13"	79°	57'	10"
Vishar (Visier, Vizier)	12°	49'	49"	79°	37'	26"
Vizagpatam	17°	41'	20"	80°	18'	0"
Walajabad (Wallajabad, Wallajahbad)	12°	47'	23"	79°	49'	27"
Wandiwash	12°	30'	10"	79°	36'	25"
Yigavaripalem (Ingawarpollium, Ingawarpolliam)	13°	27'	7"	80°	3'	30"

Milk Supply in the City of Madras

By

K. C. Ramakrishnan, M.A.

The problem of milk supply in a city like Madras is an interesting study in economic geography. The location of milk industry catering to a city, to a tropical city in particular, is governed more by considerations of demand than of the physical fitness of the area for production. The demand for milk in the Madras city is growing with the growth in its population, particularly of middle class families settling down in the suburban and other extensions. The coffee-habit is growing faster among all classes of population, though the working class cannot afford to take it with milk, while among the rest half the milk is generally consumed with coffee. The majority of the population are vegetarian by faith or by virtue of economic necessity, and therefore appreciate milk and milk products. Low as the average consumption is, there is a large and unsatisfied demand for milk.

It is difficult to get a correct idea of the quantity of production and import of milk in the city or even of the number of milch cattle actually yielding milk at any one time. The first official investigation made about 20 years ago[1] revealed that there were then 1,473 cows and 2,944 she-buffaloes in the 686 'registered' cattle yards of the city. The number of milch-cattle kept by others, one or more each for domestic use, was not taken into account, as there was, and even now there is, no need to register them. In 1932, the registered cattle yards had increased to 1776 with 3,639 cows and 4,068 she-buffaloes. According to the quinquennial cattle census of 1935, of "cattle over 3 years of age kept for milk or breeding in the city," there were 3,536 cows and 2389 she-buffaloes. As per the latest available report of the Corporation of Madras, for the year ending 31st March 1939, there were 1403 'approved' cattle yards with 3,850 cows and 5,000 she-buffaloes and 258 'unapproved' yards with 434 cows and 714 she-buffaloes. This does not include the animals kept by individual households for the supply of milk for home use.

1. A Survey of the Madras Dairy Trade by A. Carruth.

The Madras and Southern Mahratta Railway is said to have conveyed in the year ending 31st March 1939 from Guntur and Nellore districts to Tiruvottiyur (in the northern outskirts of the city of Madras where all the milch cattle are sold) about 5,000 cows and 7,000 she-buffaloes. It is not known how many of these milch cattle are taken to districts in the south and west by road or by mail, and how many stay on in the city. Nor is it known beyond doubt how many cows and buffaloes, when they get dry, are sent back to the district from which they came, for a temporary sojourn until next lactation, or permanently. It was estimated at 500 per year a few years back, but as a result of the intervention of the Agricultural Marketing Officer in Madras, the Railway has since February 1937 reduced the freight for sending back dry cows from Madras to 50 per cent of the rate for the journey to the city or Tiruvottiyur. This is said to have induced a thousand more dry animals to be sent back last year. But even then the number sent to the slaughter house in the year ending 31st March 1939 is said to have exceeded 2,000 cows and 3,000 she-buffaloes, so that nearly 40 per cent of the number of milch cattle arriving in the city every year find their end after one or two lactations. This is indeed a terrible drain and it accounts for the small number of milking animals kept at any one time in the city. We are not sure how many of these are actually yielding milk. Perhaps we may not be very wide of the truth if we put down 3,000 cows and 4,000 she-buffaloes as actually in milk every day

The cows are almost all of the Ongole breed; there is just a sprinkling of cross-bred cows; the buffaloes, with the exception of a few hundreds of Delhi or Murree breed, also come from Guntur district. These animals are undoubtedly the best milkers in this Province and it will not be an over-estimate if we take the average yield of each animal per day at 2½ Madras measures or 10 lbs. (1 gallon). The 8,000 animals may therefore account for a daily output of 20,000 Madras measures.

There is a considerable quantity of milk arriving by railway trains from villages within 25 miles of the city, from Trivellore side (N.W.), Ponneri (N.) and Tambaram (S.). It has been variously estimated from 2,000 to 4,000 Madras measures. We may take it at an average of 3,000 measures. Let us note that 20 years back when the first official survey was made this rail-borne import of milk was negligible. The issue of cheap season tickets by the M. & S. M. and S. I. Railways has facilitated this traffic. All the milk is brought by producers or their agents by passenger trains

and not consigned as parcels carried by the railways. Most of this milk is said to reach coffee and other hotels, and in a few cases some dairies in the city. Practically nothing is supplied to domestic consumers direct, though some city milkmen are found to purchase this milk at the railway stations.

The Madras Co-operative Milk Supply Union, organised in 1926, and recently equipped with pasteurisation plant, cold storage, bottling machine, etc., supplies in its motor vans about 2,000 measures per day, out of which three-fourths come from societies affiliated to the Union and located in villages in the Chingleput district, and one-fourth is from cows and buffaloes maintained within the premises of the Union itself at Iynavaram (near Perambur) or its neighbourhood. We have thus altogether about 25,000 measures or 100,000 lbs. of milk per day supplied and consumed in the city with a population of about 700,000—which means an average consumption of about 2·3 oz. per head per day! No account is taken here of the milk products—to a small extent curds and to a much larger extent butter and ghee—arriving in the city from far and near. If account were taken of these and rendered in terms of milk, the rate of consumption might be double, i.e., 5 oz. per day, which is still poorer than in northern cities of which estimates are available.[2]

The ideal prescribed for a balanced diet by the authorities of the Nutrition Research Institute at Coonoor ranges from 15 to 30 oz. per day—varying with the age and work and other conditions of persons concerned.[3] This is an impossible ideal in our country.

2. Dr. N. C. Wright's Report on Dairy Industry in India, 1937.

Municipality.	*Consumption (in oz.) per head per day of*		
	Milk.	*Ghee.*	*other milk products.*
Madras ..	1·4	0·18	0·10
Lucknow ..	1·4	0·35	0·27
Lahore ..	2·0	0·40	0·01
Agra ..	2·6	0·42	0·47
Surat ..	6·1	0·75	0·35
Amritsar ..	7·3	1·25	2·61

3. Health Bulletin, No. 23, by Dr. Aykroyd.

For even in England the actual consumption per capita is about 10 oz. only per day. But people there consume a lot of meat and fish and eggs, which like milk are first class 'protective foods'. In a poor country like ours 8 oz. may be deemed a workable ideal. The well-to-do citizens of Madras do consume at least 8 oz. per head of milk, not including the intake of ghee. The middle class, a very composite class, may be taking anything from 4 to 8 oz. including the milk that goes to the making of ghee. Milk is indeed the most variable item in the diets of the members of this class. The working classes consume very little of milk (1·25 oz. on an average per day) as was revealed by an intensive study of their Family Budgets collected in the city in 1935.[4]

The price of milk in Madras, though its quality is poor, is greater than that of milk of richer quality sold in London, which gets its supply of milk from great distances—50 miles and upwards—where the cows live in a more natural environment in the countryside. Not only England, but several other European countries—notably Denmark, Holland, and Switzerland, not to speak of Ireland—have splendid pasture grounds and all of them supplement their natural supply of grass with special leguminous fodder crops and root crops, which are carefully stored and supplied during winter when animals are stall-fed, and with oil cakes, mostly imported. Our city cows get no doubt a richer ration in the stalls in their milking period in the shape of oil-cakes and pulse husks than what they could get in the villages at the hands of poorer farmers; but it is often an ill-balanced diet. They get little or no succulent grass or fodder in any part of the year and most of them are tied to the cattle shed all through the year, except when they are trotted out in the morning and evening for milking at customers' doors. Perhaps a few cows in the spacious compounds of the rich are more fortunate; but not all the rich keep cows in spacious compounds. Many of these are kept in congested residential quarters in George Town, in the little cattle yards and verandahs of pucca houses fouling the air all round.

The vast majority of the cows and buffaloes suffer in the stuffy hells called cattle sheds in the city, with little more than elbow space in most of them. The 'model cattle yards', built by the Corporation of Madras, accommodate about 500 animals; but they are not models that we would advocate. Cows and buffaloes which

4. *Family Budgets of Industrial Workers in Madras City* by N. K. Adyanthaya, p. 31.

have been bred in the rural areas of Guntur and Nellore, where the soil is rich in lime and the climate is drier, cannot thrive well in the humid climate and congested condition of the city. Due to the lack of fresh air, fresh water and grounds to roam about, many of them become poor yielders in the course of a few years and with the unsystematic breeding practised by the generality of milkmen in the city, it is often deemed wiser to dispose of the deteriorated animals to the butchers at a low price. This is no doubt in direct violation of the Hindu veneration for cows but it is the inexorable economic pressure, the cost of maintaining a dry cow without sufficient recompense in the next lactation in many cases that drives the milkman to turn a deaf ear to sentimental appeals.

The keeping of cows is a speculative proposition in the city of Madras. The cost of maintenance of a cow in milk, including the purchase of oil-cakes, bran and pulse husk, and the labour charges works out on an average to 9 annas per day. Interest on capital cost, rent of stalls, and taxes might amount to 3 annas per day per animal. If the yield of milk per cow is 2½ measures per day, it fetches Re. 1 per day, which leaves a net income of 4 annas per day. Cow-dung is given away in lieu of conjee or rice water. Taking 8 months as the average period of lactation, the income from milk is Rs. 60 per cow per lactation. A good milking animal would cost at least Rs. 100 per head. But when it turns dry, it is worth only Rs. 30. The lean calf, if one survives, after lactation is not worth much. There is, therefore, a heavy depreciation which is not made up for by the net income. A cow does not often pay its way; the buffalo is a little better. No wonder, the Madras dairy trade has been condemned as a bankrupt trade and there is some justification for all the sleight-of-hand tricks at adulteration by the milkmen. Buffalo-milk is toned down by the addition of water and sold as cow's milk; milk is warmed and the cream is skimmed off and the rest is sold as whole milk.

Milk is a comparatively bulky commodity, highly perishable and inconvenient to carry long distances except in vehicles of the perfectly smooth-running type on first class roads. Milk is demanded early in the morning and as fresh as possible. In view of the extraordinary facility in diluting and adulterating milk, the well-to-do housewife insists on the milking of the animal in her presence at her house. It is not given to the poor to indulge in this luxury on account of the very limited individual demand of each family, which has to buy what is offered at a lower price. We witness, therefore, the unnatural and cruel spectacle of the city cow being taken from house to house and forced to yield its milk

morning and evening often in instalments at more than one house. Still, how many of these consumers could be sure of the purity or the quality of milk ? The sleight-of-hand tricks practised by the experienced milkman in diluting the milk even while the cow is milked at the house of the consumer can only be detected by the very wary observer. Even when milk is not so diluted, it is not rich in quality for two reasons. If the cow is milked in more than one house, the first served always gets poorer quality of milk with low butter fat contents, so low indeed that children cannot thrive on such milk, while the last served gets the milk too rich in fat. Even if a consumer gets the entire supply of milk of a cow, the milk of city-bred cows is inferior in quality because of the total absence of succulent fodder and inadequate stall feeding. There is at present practically no pasture ground in the city, though here and there cattle are turned to graze on what are really standing grounds. Madras is said to have had plenty of pasture grounds a hundred years back, when the population was far smaller and the number of animals very limited. Even 40 years back it was common for most of the gentry in Madras to keep a cow or more each in their spacious compounds and send them out for grazing in charge of servants. But on account of the building activities in the city, especially in the post-war period, there is practically no pasture or exercising ground for cattle within the city proper—barring the play grounds like those on the Island on which we find a number of cattle are turned. Even cut-grass which is brought in head loads for some period after the rains is bought more for horses than for cows or buffaloes, which have to be satisfied with dry straw. Naturally cattle accustomed to rich green fodder-grasses and cholam stalk in their original homes, deteriorate for want of succulent fodder in the city.

If the dairy industry should be placed on a profitable basis, the animals maintained in a natural environment with more space to move about, and insanitary practices inevitable in the keeping of a large number of cattle within the city done away with, it is necessary to remove all the cattle outside the city. There must be a search for vast open spaces round about the city, within a radius of 20 miles, where on cultivable land fodder crops could be raised so intensively as to replace economically the dry rain-fed paddy and millets raised at present. Lands growing more valuable crops like wet paddy, plantains, sugarcane, betel and vegetables should not be disturbed; but these crops cover only a small area comparatively. The wastes that cannot be reclaimed for cultivation by the plough may yet serve as pasture ground or at least

exercising ground for cattle. What is needed is an intensive survey by an expert committee of the soil, climate, irrigation and other facilities in the neighbourhood of the city for the raising of forage crops and the maintenance of milch cattle of the finest breeds. City conditions offer little scope for better breeding and rearing of cattle, without which the cost of milk cannot be brought down.

It may be too drastic a step to take—to clear at one stroke the city of all milch cattle. But this may be done by stages; the most congested quarters may first be cleared; cattle in private compounds of more than a fixed area may be taken away last. With the increasing demand for house-sites it will only be a natural adjustment. Such removal of cattle has been found necessary in all big cities in the West. They are contemplating it in Bombay[5] and in Calcutta where the evils of city-bred cattle and cruelties inflicted by milkmen on them are, if anything, worse than in Madras.

There are, however, new and difficult problems which the shifting of the source of milk supply away from the City is bound to create. Consumers in the City want fresh, unspoilt, unadulterated milk at an early hour in the morning so as to have their morning coffee between 6 and 7. Absolute freshness is impossible as milk will have to travel 10 to 20 miles. Milking at the untimely hour—between 3 and 4 a.m.—is relished neither by the cow nor the milkman in the village, especially if milking is only a sideline to agriculture. Even if milking is done at a very early hour, milk will have to travel over rough roads, at least until the main trunk road is reached. This is sure to tell on the quality of milk. And in the evening when it is much warmer, milk gets spoiled sooner by transport. Milk does not get spoiled for 24 hours in cooler climates, but in South India it rarely keeps well for more than 6 hours. With the best of intentions, therefore, milk may get spoiled in the local conditions of production and transport. Freedom from adulteration and contamination can be guaranteed only when there is a reliable agency to look after the milk from the stage of milking the animal in the village to that of delivery at a central depot for mere bottling or canning before distribution or for pasteurisation in addition, as is done by the Madras Milk Supply Union at Iynavaram.

5. The Government of Bombay contemplate the removal of cattle sheds from the city to places like Palghar or Trombay having plenty of grazing grounds and the formation of a public limited company with a capital of Rs. 20 lakhs with exclusive rights to sell milk of quality at 100 distributing centres; or the municipal corporation will be asked to take up the question.

Pasteurisation and cold storage before delivery are done with a view to ensure clean and disease-free milk and to keep the milk in a safe condition for at least 12 hours in our warm climate and thus avoid too early milking of cows in the villages. The danger, however, will still be there, if from the beginning of milking in the village and after taking delivery of milk from cold storage scrupulous care is not exercised in the handling and conveying of milk. Pasteurisation will have to be done in perhaps half a dozen centres at different approaches to the City and not in one central place. This may be worthwhile doing only when practically all the supplies come from outside the City and not partly from within. Bulk handling is essential for reduction of costs. If milk can be transported within six hours after it is milked, it may not be necessary to resort to pasteurisation at all, especially as milk in our country is seldom used without boiling, though we are told we are thereby losing some vitamins. Even then a number of depots will be necessary to collect milk coming from different directions into the City. It is impossible for individual producers to meet consumers in the City. The best organisation for collection and distribution would be a co-operative organisation like the Madras Milk Supply Union. Municipalisation of milk supply is an alternative that has often been canvassed; but the record of municipal control of adulteration, not to speak of other municipal enterprises, is not even as good as that of co-operative control and trade. The Geographical Conference is not the best place to discuss the pros and cons of co-operative *v.* municipal milk-supply. But it is necessary to understand the implications of the suggestion to transfer the source of milk-supply from the City to the rural parts round about.

Cinchona Cultivation in India

By

K. N. PASUPATHI, B.A., L.T.

Few people perhaps are aware that quinine, the well-known, *popular and cheap remedy for Malaria in all its forms*, is made in India ; and fewer still perhaps know that the Madras Government manufacture it. There are two factories both of them, government concerns—manufacturing quinine and allied drugs. One of them is situated in Mungpoo on the Darjeeling Himalayan Railway in Bengal, and the other, at Naduvatam, in the Nilgiris, on the Ootacamund-Mysore Road. The latter is owned and managed by the Madras Government and run on a semi-commercial basis in that the department, known as the Cinchona department, is self-supporting. The department makes only a small profit, its main object being to make cheap quinine available to the suffering masses through hospitals and post-offices.

Quinine is obtained from the bark of a plant which really grows into a tree, twenty feet high and more, called Cinchona and named after its discoverer, Conde del Chinchon, the wife of a Viceroy of Peru, in South America. She was cured of an intermittent fever while in Peru in 1638, thanks to the administration by the natives of the powdered bark of cinchona. How the native Peruvians acquired the knowledge of the virtues of this bark is not exactly known. In 1640 the Jesuits in Spain had the bark sent to them by their breathren in Peru. And for nearly two centuries, the drug was administered in the form of a decoction of powdered cinchona bark, the alkaloids in it not having been "isolated" till the nineteenth century.

The plant was brought to Europe by the Countess of Chincon, when the surprisingly successful, curative effects of the bark were noticed. Its uses were soon recognised. A regular and scientific cultivation of the plant was carried out in the course of the 19th century in different parts of the world, the most successful of them being in Java. The Indian plantations, those in the Nilgiris and in the Himalayas, were considered, about 70 years ago, to be the most promising and likely to become the world supplier. But, for reasons not yet thoroughly investigated, India now holds a rather backward place in the world as a Cinchona-supplier.

The Java plantations which are owned and managed chiefly by the Dutch are now the leading world suppliers ; and this pre-eminent position of Java is mainly attributable to the systematic and scientific cultivation of the plant combined with the hard work of the Dutch planters.

There are three varieties of Cinchona bark : (1) Ledgerina or Ledger ; (2) Succirubra and (3) Hybrid, which is obtained by hybridising Ledger and Succirubra. The Ledgerina, largely found in Sikkim, has a high percentage of quinine content, though it is a very delicate plant and its successful cultivation is therefore rather difficult. A good sample of this variety has a quinine content of 7 or 8 per cent, and 12 to 13 per cent of total alkaloids. This plant flourishes well at an altitude of 3,000 feet, such as in the Wynaad.

The second species, Succirubra, grows at a higher elevation, above 7,000 feet. It is a weak, straggling tree attaining to a height of about twenty feet, largely grown in the Nilgiris, Ceylon and Sikkim. It is the most important plant cultivated in the Nilgiris. It is more robust than the Ledger, and needs less care. But it yields only about three per cent of quinine, and seven or eight per cent of total alkaloids.

The hybrid, on the contrary, is a happy blending of the two species above-named. It combines the sturdiness or robustness of Succirubra with the richness of Ledgerina. This is a very popular variety now. But, for cleanness in extraction work, the chemical extraction of quinine, alkaloids etc., there is nothing to equal Ledger bark.

All the three varieties are cultivated in the Madras Government plantations. These are found in three different places : (1) at Naduvatum, the biggest area, about 1,000 acres being under cultivation ; (2) at Doddabetta, about 200 acres ; and (3) in the Anamalai Hills, about 600 acres.

Cinchona grows best above an altitude of 3,000 feet, and that explains why all plantations are in the hills. It requires a cool climate, in which the contrasts between summer and winter, between day and night, are not very great. At Ooty, about 7,500 feet above the sea, the minimum lowest temperature in the shade is about 50 degrees F., the maximum being 70 degrees F. At Naduvatam, 2,000 feet lower down, the minimum is 54 degrees F. and the maximum 66 degrees F. In the Nilgiris, all species make their vigorous growth during the time when sunshine and shower alternate. They

grow for two months after the rains cease. The rainfall at Ootacamund is 44 inches; at Naduvatam, 105 inches. It is about 165 inches in the Sikkim plantations. But the plants are impatient of stagnant moisture. They require an open, gravelly subsoil, a sloping exposure and a rich loam to dry, clay soil.

Each cinchona plant is provided with a shading tree and the one selected for this purpose, at Naduvatam, is the Silver Oak. The plant has to be protected too against heavy winds. Seeds are planted first, and the small seedlings have to be transplanted three or four times and carefully nurtured until they attain the age of two or three years. When mature, the tree is scraped for bark—that is, after seven or eight years. It is this pretty long period of waiting for returns that highly discourages most Indian planters who often prefer growing tea or coffee which yield in two or three years. This is one of the reasons why private enterprise in Cinchona cultivation is so poor. Want of a proper knowledge of cultivation and lack of capital are of course other reasons. The government has recently investigated the possibilities of increasing Cinchona cultivation in India by encouraging private enterprise and it is to be hoped that this encouragement will be soon forthcoming.

Cinchona bark contains principally the Cinchona alkaloids which are estimated to be about 200 in number; tannin, useful for tanning purposes; and colouring matter, called Cinchona red. In quinine extraction all others are rejected except Cinchona alkaloids which are known as quinine, Cinchonidine, Cinchonine, Quinidine and amorphous alkaloids comprising the rest. The most essential and powerful remedial agent in Cinchona bark is termed quinine.

The Madras Government puts on the market Quinine Sulphate, the pink powder and tablets sold in Post offices—and other salts of Quinine such as Quinine Hydrochloride, Quinine Bi-hydrochloride, Quinine Bi-sulphate, etc., as well as Febrifuge and Totaquina, made from residues and used as a cheaper substitute for Quinine. Totaquina, though made from residues, is made strictly to the standards laid down by the Health Department of the League of Nations. This contains too more quinine than Febrifuge and is moderate in price. It is a standard preparation recognised by the medical authorities.

The curative properties of Quinine and allied drugs have been tested and found almost infallible. To a malarial ridden country like India, the problem of quinine supply is of very great importance. It is the best drug for treatment: the more quinine, the

lower the malarial death-rate. In all countries, generally, the supply is found to be insufficient, and the cry is for more quinine at lower price. We know that to-day, the Netherlands Indies produce about 90% of the world's supply in the mountain districts of Java.

Almost every human disease which shows a tendency to recur in regular fits or paroxysms is alleviated by the use of quinine. Hence its value is great not only for treating malaria but also for neuralgia, whooping cough, etc. It is also reputed to be a powerful, though unpalatable, tonic, when administered in small doses. As an antiseptic for treating wounds and in the treatment of pneumonia, it has been found efficacious too.

To make consumption easier, Quinine is supplied in the form of tablets. The Madras Government's factory at Naduvatam turns out about 22,000 lbs. of quinine every year. Here the production is limited owing to the inadequate supply of Cinchona bark, in spite of the purchase of bark from Bengal. Purchase from Java seems to have been now discontinued.

The need for increasing the production of quinine is acute. It ean be done by increasing the area of cultivation of Cinchona as well as by increasing the productivity of the areas under cultivation. The Imperial Council of Agricultural Research in India recently investigated the question of increasing the area under Cinchona cultivation. As for increasing the productivity of the areas and the quality of bark in respect of its alkaloid contents, planned, experimental work is necessary.

The following figures taken from the Report of the Botanical Survey of India for 1937-38 explain the position of quinine production and supply in India:—

"India's stock of bark opened with a balance of about 494,600 lbs., of which Java bark was about 170,100 lbs. The bark treated at the Mungpoo factory of the Bengal Government was about 120,050 lbs., yielding about 4,400 lbs. of quinine and 2,000 lbs. of Cinchona febrifuge. The sale of Quinine Sulphate tablets rose from 340 lbs. to 2,400 lbs., the bulk of the supply going to the Punjab. The total revenue realised from the sale of Cinchona products was about Rs. 4,48,100. The year opened with a total stock of about 1,30,940 lbs. of quinine and ended with 1,12,560 lbs."

The two Indian factories, that of Madras and the other of Bengal, supply quinine to hospitals, jails and post-offices in India. Still, imports of the drug have to be made to meet the increased

demand. A successful industry, by private enterprise, would be the best solution to the problem.

In Java, both the climate and soil are peculiarly favourable to the cultivation of Cinchona with a high percentage of quinine. So Java will always hold its own against India. In the world to-day, there are about twenty quinine factories, about a dozen of them being in France, England, Germany and Holland put together; 4 or 5 in America; 2 in India; and 1 in Java.

Now, India has been given a liberal supply of this invaluable drug-quinine, at a remarkably low price: the post office sells a packet of 20 tablets for five annas. The working of the Indian plantations has given employment to numbers of poor people. If enterprising Indian planters who own sufficient capital and command the necessary knowledge of the subject come forward to invest it in Cinchona cultivation in India, there is bound to be a prosperous future not only for themselves, but also for the millions of poor people in India to whom the quinine tablets, cheap as they are, are still not within easy reach. The Government of India must do all it can to encourage private enterprise in Cinchona.

Muslim Contributions to Geography

BY

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Greek and Roman contributions to Geography reach their high water mark with Ptolemy, and it would not be too much to say, that with him the story of ancient discovery comes to an end. Books in Greek and Latin ceased to have more information and gradually the Dark Age of Geography set in, with a negation of the Spirit of inquiry which generally characterises the early centuries of the Christian era. The pagan Greeks and their intellectual attainments failed to find favour with Christian Savants and later under the shadow of the proselytizing zeal of the Great Constantine things worldly ceased to charm the human mind. In short, early Christian teachings deliberately avoided pre-Christian Geographical theory. In the words of St. Ambrose "to consider the nature and position of the earth does not help us in our hope of the life to come."

The introduction of new extravagances began to replace the so-called pagan views, the end of the world was freely anticipated in 1000 A.D. and the spherical shape of the earth and the existence of antipodes were subjects of ridicule. Monk Cosmos carried these ideas to their logical conclusion by entirely refuting the pre-Christian view about cosmography (astronomical geography) in his work "Christian Topography". His earth was flat, rectangular, and oblong, twice as long from East to West as from North to South, and was surrounded by oceans. In addition a high mountain rose in the north behind which the tiny sun played hide and seek to bring forth day and night and then, beyond the unknown of the vast oceans lay Paradise! These conceptions about the earth remained the fundamental teachings of what we can call the 'School of Violent denial.' It is in fact against such a background that are to be judged the merits of the Geographical works of the early Muslims who rekindled the spirit of Classical Greece, nay carried it a step further in enriching geographical thought.

The Arabs were indeed the heirs of that Hellenistic Culture, for which a way was first opened by the conquests of Alexander

and which became so widely diffused throughout the eastern provinces of the later Roman Empire. Nearly all the deeper wisdom of the Greek thought became handy to the Arab-speaking world because works of noted authors were translated. And thus the heritage of Classical Greece helped to enrich a new civilization. Arnold very aptly remarks "Western Europe is apt to view the Muhammadan world as something entirely remote from itself; such a judgment leaves out of consideration that both the Christian West and the Muhammadan East are in many respects heirs of the same vivifying cultural influences and that Islam in the ultimate analysis of its civilization reveals itself as the aftermath of Hellenism in the East." The translation of Ptolemy in fact laid the foundation of that Geographical Science which the Muslims carried so far. Above all, geography formed part of that broader learning which was often cultivated for its own sake and displays so much balance, sanity and accuracy based on observation of actual facts.

The rise of the Prophet Muhammad is one of the most stupendous events in history. He appeared at a time when the Persian and the Byzantine Empires were exhausted by a prolonged conflict The Arabs became the upholders of a creed which united them In addition, attracted by the love of riches and spoils awaiting them, they raised the structure of an Empire the equal of which had not been seen. On the one hand it touched the borders of China and on the other it was washed by the waves of the Atlantic a distance of some 7,000 miles. Further, Islam seems to have given the Arabs a pyschological impulse to diffuse their culture *The behest of the prophet "Go unto China to acquire* knowledge," explains the strong urge to visit far-flung areas. An extensive commercial activity and the vastness of the Muslim world offered unlimited scope for the increase of knowledge.

Two things must be borne in mind in connection with the scope and the influence of Muslim Geographical thought. Firstly their contribution was not only immense but reveals a distinct advance over Classical achievements generally. Secondly, it influenced Europe perhaps only indirectly and in a limited sense, because of the prejudices and ignorance of contemporary Europe which was accentuated due to the long-drawn conflict between the Cross and the Crescent.

Taking the Muslim contributions to Geography as a whole it is convenient study to resort to a fourfold division. (1) Descriptive Geography, (2) Advancement of Geographical conceptions

and geographical interpretations, (3) Astronomical and Mathematical geography, (4) Cartography.

Descriptive Geography can be taken to include a detailed knowledge of various places and countries of the world, along with the descriptions of the ways and lives of their peoples. In addition to Roman knowledge of lands and seas the Arabs were better acquainted with four other regions, hitherto only vaguely known.

Strabo and Ptolemy's knowledge about the regions round the Caspian Sea and the N. E. of the black Sea was very scanty. Pliny regarded the Scythians as cannibals, while Ptolemy's Sea of Azov extended upto the site of present Moscow. The sea of Aral was not mentioned at all. The lake of Khowarzm (Aral) is represented on a map of Khalif Al Mamum's days for the first time. Many expeditions were sent in this direction from Baghdad. In 1921 Ibn Fozlan visited South-Eastern Russia and leaves the first reliable account of the area. After this numerous Arab traders followed in this direction, went from S. Russia to Poland and extended their trading activities to Scandinavian countries. The evidence is borne out by the fact that in Sweden alone more than 30,000 Arab coins have been collected.

In those early times, the frequency of typhoons and the danger of the pirates were positive menace to sea ventures in Far Eastern Waters. The Roman trade with South-Eastern China was directed through the Burma-Yunnan route and their knowledge about Malaya and East Indies was inaccurate. Ptolemy had supposed that South-Eastern Asia extended westwards in the South, to join with Africa, thereby making the Indian Ocean a landlocked body. Undoubtedly, Arab and Persian maritime activity had been extended to Chinese waters before the advent of Islam. But with the rising tide of the new religion the Prophet wished his message to be taken to China. Arabs thus reached Canton, built a mosque and founded settlements with Chinese goodwill. The first accounts about these regions are those of Sulaiman the merchant and Abu Zeyad also known as Hasan of Siraf, in the second half of the 9th Century. Later on, Ibn Battuta's remarkable travels gave much information in this direction.

The Greeks and the Romans had frequented the East African coast and the former had also founded coastal settlements. But their activity was largely confined to the littoral portions. Muslims not only claim many maritime adventures in these seas but also seriously undertook inland penetration upto the coast of modern

Natal. The adventures of Sindbad the sailor are very largely concerned with exploits off the African Coast. No doubt much of fact is mixed with fiction in the narration of such events, but a great deal of knowledge about these lands was forthcoming.

Roman "Africa" largely meant Mediterranean Coastal regions plus the bordering desert fringes and Egypt. Soon after the conquest of Egypt the Arabs penerated into the Sahara, explored Sudan and established friendly relations with Habash (Abbyssinia).

In fact such vast expansions in the knowledge about descriptive geography, were possible—among other factors—on account of extensive commercial activity, political and spiritual dominance of the Muslims and the remarkable achievements of intrepid travellers like Ibn Fozlan, Alberuni, Ibn Haukal, Masoudi and Ibn Battuta and seamen of the calibre of Sindbad. The annual congregations at Mecca provided vast opportunities for the exchange of views, story-telling and narration of events, when thousands of Muslims from different climes and far-off lands met their co-religionists.

The Arabs did not only increase the geographical knowledge of new lands in Asia and Africa, but what is more creditable they contributed to methods of geographical interpretations, which can be regarded as the earliest beginnings of a "regional conception" in Geography which preceded modern sociological and human studies by so many centuries. Thus many of their works in Geography reveal a study of cause and effect to explain man's reactions to his environment, and herein certainly lies their superiority over their Greek and Roman masters. In fact the Arabs made a serious departure from old traditions by pulling geographical studies out of the dominating astronomical and mathematical tangle. Even that great master, Ptolemy, can be described to be "more of an astronomer than a geographer." He used his net of longitude and latitude to devise a mathematical division of the world, upon which were based his geographical regions, without any attention being paid to physical and political boundaries. As Arab geographical studies developed, this method was found increasingly unsatisfactory and gradually the new approach of a "Regional Study" based upon the study of geographical surroundings and their influence on human activity, began to be increasingly adopted.

Valuable Muslim contributions in this connection grew out of the rich intellectual pursuits of the period of the Abbasid dynasty (Bannu Abbas). An account of the works of some leading geo-

graphical writers of this age is of enormous interest. Ibn Khurdadbeh is one of the pioneers of Arab Geography. He was a chief post-master who compiled his book 'on Routes and Kingdoms' in 850. This work though steeped in the tradition of the 'Ptolemaic School' is useful in giving a summary of the trade routes of the then Arab world. Unfortunately the descriptions are coloured with fabulous story-telling. His works provide us with descriptions of such distant lands as China, Japan and Korea. Yakouti wrote about 900 A.D., his Gazetteer-like compilation, "The book of Countries," giving details and names of numerous places and their distances, but what is more important he relates a series of facts based on physical aspects, explaining the human geography of many areas. Because of his industry and accuracy Yakouti is sometimes regarded as the father of Arab Geography.

The next great figure is that of Ibn Haukal who travelled far and wide for over 30 years (953-88 A.D). He wrote a comprehensive account of his journeys and furnishes a geographical, political and economic account of the vast domains of the Islamic Khalifate. Ibn Haukal's geographical conceptions were based in his own words, on "Geography being a science which interests princes and peoples of all classes." Istakhari the merchant traveller and a contemporary of Ibn Haukal compiled his "Book of Climates." Masoudi remains an outstanding Muslim Geographer and like several Arab Savants his writings are based on sound personal observations. He tramped all over the known world from Spain in the West to Turkistan in the East, while Sofala, Zanzibar, Sind, China and Madagascar all are mentioned by him. Sir Percy Sykes regards Masoudi's encyclopaedic works to be of a very high order. His book 'Meadows of Gold and Mines of precious stones," is an application of geographic principles to history. Masoudi's map of the world was compiled in 956 A.D. Bu Ali Sina of Bokhara, the Avecenna of Europeans, though noted for his philosophic learnings, was also a keen student of Geography. According to Howarth, he can perhaps be credited with ideas as to the elevation of mountains by folding and their sculpturing by erosion and also the long period necessary to such processes which appear almost to anticipate modern physiographic studies.

Idris (1099-1154 A.D.) is familiar to Europeans because he was a native of Spain and spent his later fruitful years at the court of King Roger II of Sicily. He was a product of the great Cordova University, early acquired a 'wander lust', travelled through Africa and Asia Minor, visited the shores of France and England and

ultimately settled down in Sicily. He made a celestial sphere and a map of the world in silver for King Roger and later wrote a description of the world based on the reports of observers sent out by Roger. Among Arab Geographers his knowledge about Europe is fuller and his navigation Charts reach a high level. Yakouti (1179-1223 A.D.) of Merv wrote his 'dictionary' providing descriptions of vast and varied areas with remarkable accuracy and Abul Fida (1273-1331 A.D.) was the author of a useful 'Geography.'

An account of the development of geographical learning remains spiceless and incomplete without a mention of the wonderful travels and writings of Ibn Battutā (1304-78 A.D.) who was born at Tangier on the North African coast. His momentous travels lasted for over 30 years till a young man of 20 grew into an old man of 50. His three great journeys extended to over 75,000 miles and took him to East Africa, India, Malaya, Archiplelago, Syria. Arabia, Asia Minor, Caspian and Black Sea areas and Spain. Finally he returned to Fez in Morocco and dictated accounts of his wanderings. which are certainly the most remarkable ever compiled. They contain a mine of Geographical information. It is a pity that contemporary Europe failed to benefit from his wisdom due to its ignorance.

But it is with Ibn Khaldur, that great master, that scientific geographic interpretations reach their high water mark. Undoubtedly he was the greatest historical thinker of Islam and his 'Universal History,' has few equals in intellectual compilations. Ibn Khaldur (1332-1486) worked at Tunis. It is to his Introduction to 'Universal History' that geographers are greatly indebted. He was one of the early pioneers of Social Science and his attempts at correlation of environment with human activity, contained in the Introduction, entitle him to be called the forerunner of later geographical thought in the 19th Century. His geographical accounts are placed in the beginning of his work for the proper understanding of sociology and history. In the words of Hozayen, "He attempts to trace the effects of both climatic conditions and local environment upon the physical and mental qualities of different peoples. He treats the whole subject in a modern scientific manner. Ibn Khaldur also inaugurated an elementary classification of different modes of life by distinguishing between what he calls *Badyia* (land of nomadic life) and *Hadar* (place of settled life). To this study he adds many remarks on the type of habitat in the Badyia, and the geographical factors which affect the rise and development of the "City." It is in such remarks, scattered in

his Introduction, and in most cases suffused by his sociological studies, that lies the interest of his work as a proto-type of modern human and social geography.

It is regrettable that such scientific traditions were discarded by Muslims in the midst of the general decay which engulfed their culture and learning. And it was no less unfortunate that through deep-rooted prejudices the Baleric and Germanic Schools of Mathematical and Cartographical development in Mediaeval Europė, failed to be influenced by Islamic descriptive and social geography. Thus followed many centuries of retrograde geographical conceptions.

In the sphere of Astronomical and Mathematical Geography the Muslim contributions show a distinct improvement over Greek and Roman sources. Arabs being the children of the desert were naturally much interested in astronomical observations and their contributions in mathematics are bright. The spherical shape of the earth and its rotation and revolution were common accepted facts at the Universities of Cordova, Seville and Baghdad. The use of the Compass was perhaps wide in maritime activities, the Sundial was further improved and the representation of latitudes and longitudes was a common features of maps. The Tower of observation at Seville still stands as a monument to the urge for accuracy in the study of natural phenomena.

Muslim Cartography failed to attain high standards because of the Arabs' love for decoration. In many works the picturesque is preferred to the accurate. In general representation of the world on a map, the older Greek and Babylonian conception of the engirdling ocean returns because of the increased Arab maritime activity taking them to wider oceans. The Ptolemaic conception of a land-locked Indian Ocean disappeared and a vague idea of the vastness of the Pacific and the Atlantic Oceans tempted them to revert to the recognition of a surrounding expanse of water.

Certainly in many respects, in pure Cartography, Medieaval Europe was in advance of the Arabs, but elsewhere the latter were undisputed masters.

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Physiographic Divisions of India

By

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Last year, in the Discussion Paper read by me on "The Need of Uniformity in the Physiographic Divisions of India", before the Lahore Session of the Indian Science Congress, I proposed a tentative scheme, which, for some reasons, was not accepted by the Members present. As the discussion was actually held under the joint auspices of the Sections of Geography, Geology, Physics (for meteorologists), Botany and Zoology, it was intended that with the help and co-operation of all the Scientists concerned, some kind of aggreement would be arrived at. But the criticism, passed at the meeting, appeared to me to be one-sided, and, for want of sufficient time, was brought suddenly to a close.

Subsequently, therefore, I distributed printed copies of my Paper among some competent Indian and foreign geographers and I have now obtained their opinions. They have, without an exception, welcomed the principle of dividing the country *physiographically* as suggested by me and accepted the fundamentals of such a division, *viz.*, geological structure (including economic resources) and history of erosion (including climate), due regard having been paid to the prominent topographical features. They have agreed upon rejecting all mixed, political and other artificial criterea for it. Unscientific notions about the so-called "natural" regions of India have been discarded and the idea of limiting the geographer, in a precise and specific manner, to geomorphological considerations in the first place, while producing the chief divisions, has found favour. Over such scientific and logical divisions of the country, all matters relating to climate, natural vegetation and even human settlement must drape themselves completely and to the satisfaction of all other advocates of allied sciences.

Geomorphological Data.

The disagreement which prevailed among my critics, was really in regard to the matter of details, the manner of approach

and the lack of geomorphological data to work upon. But I contend that in the numerous Records and Memoirs of the Geological Survey of India, there is really enough and precious material regarding land-forms, types of topography etc., for us geographers to sift from. In fact, I found the material in connection with my studies of the Indus Basin very reliable and useful. It is neither necessary nor possible for us, at this stage, to explore the whole of India from end to end, but it is enough for our purpose to know the history of erosion and subaerial denudation and to describe as fully as possible, the land-forms.

Aerial Reconnaissances

What would indeed be very valuable and creditable to us, Indian geographers, in this connection of regional surveys in India, is aerial reconnaissances. It would really be worth our while to 'resurvey' our land from the air and to check the data secured from geological surveys in the past. With a camera and 1 inch topographical survey maps, now obtainable in our country, it is possible to visualise much excellent local material, to supplement our literary and cartographical knowledge. Amateur pilots, who are friendly, should be our best friends now to help us to collect more and more geomorphological data.

Thus it is possible to supplement the work done by the Survey. Such an experience and personal knowledge of local geographers, who live within certain regions, would be most welcome to us in solving certain difficulties involving local problems while fixing the actual boundaries, minor divisions and sub-sections. Thus a large step forward can be taken by preparing at least a *Map* of India, showing the physiographic regions, at any rate.

In the light of the above facts and considerations, I have now prepared a revised edition of my Paper and the Map, especially with regard to (1) the more important Provinces, and sections. (2) their nomenclature and (3) the mode of numbering them. As before, minor geographical peculiarities have been subordinated to the main features. At the same time, I have made corrections of certain errors, that had crept in, and additions of facts, in further support of my scheme.

Alterations made in the Scheme

Extra-Peninsular Mountains.—In the Western Highland Province, the Kirthar-Suleiman ranges are considered as one and continuous.

The Kashmir Valley is renamed the Dun Section, as it is a typical Himalayan Dun, as a result of thrustfaulting.

Instead of taking a frontier (i.e. political) section by itself, I have included the Potwar region in it, as it is related to it, and given the whole the name of the Potwar Section.

The Eastern Highlands: In dividing this region, some details had been mixed up. e.g. Shillong plateau, made up of crystalline complex, a horst so to say, between the Himalayas proper and the folded Tertiary rocks of Assam and Burma. It has, really speaking, a veneer of undifferentiated Tertiaries covering parts of Assam and merging into the Burmese Yomas. The Irrawadi Basin is a most convenient physiographic region in these parts with all their precious mineral oil wells. And lastly, the Shan Plateau again is another block of Archaean rocks, separated by plains, valleys and lakes. (A separate map of Burma with its own divisions would be better still).

Indo-Gangetic Plain.—In the Upper Indus Valley, the two Sections required are: the Doab Section of higher (Bhangar) ground cut up by the Punjab rivers and the Punjab proper of low lands (Khadar) upto the junction (Panchnal) of the Indus with the Five Rivers, from where the Lower Indus Basin should be really marked.

In the Upper Ganges Valley, the Doab Section is re-named Jamna-Ganges Doab and in the Lower Ganges Valley, the Sections are marked as the Brahmaputra Valley, the Old Ganges Delta and the New Ganges Delta.

The Peninsular Area.—This area is somewhat overhauled. The two coastal strips are not treated as separate Provinces, but as the shore-facies (Sections) of their respective structural Provinces, viz., the Konkan Coast belonging to the Deccan Trap Province and the Malabar and Coromondel Coast lands belonging to the Southern Plateau. Kathiawar, consisting of threefold region, with the important Rann of Cutch and the Northern Plain of Gujarat, is separated and called the Western Peneplains.

Several Sub-Sections have been pointed out in the Provinces of North-Eastern Foreland (as a complex group of denuded rocks) and the Southern Plateau (mainly consisting of Crystalline Complex), to satisfy the needs of botanists, meteorologists and others.

Thus to the minor divisions and Sections, previously made, I have added some 29 Sub-Sections, leaving room for more to be

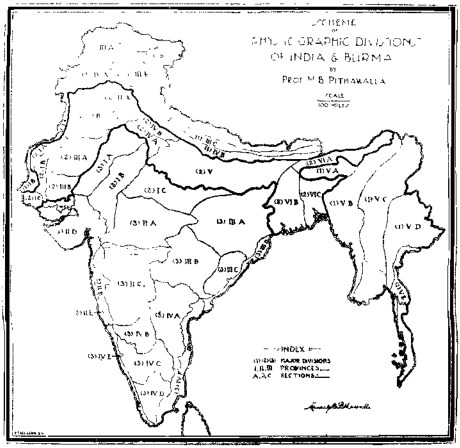
formed by local geographers and the scheme is made comprehensive, so as to give ample opportunities to them to consider the claims and requirements of all departments. Once these divisions are settled and the Map is completed, our next step will be to try and fix the boundary lines actually on the surface.

Revised List of Physiographic Divisions of India

(1) EXTRA-PENINSULAR MOUNTAINS.

Province I. Western Highlands.

Section A. *Kirthar-Suleiman Mountains.*—Barren mountains nearly 6,000 feet high and consisting of folded Tertiary rocks. The



monsoons do not reach here, and there is little soil left on top. Subaerial denudations considerable, forming small plateaus. Inland drainage. Coal seams found within the re-entrant angle between the two ranges.

Section B. *Kohistan Section.*—Lower ranges with slightly more rainfall including winter showers received from western depressions. Subaerial denudation is greater with the resulting broad anticlinical valleys in which a little soil is available for grass to grow. Many hot springs due to fractures in the folds of rocks. Typical dryland topography of limestone country. Some chances of mineral oil deposits.

Province II. Greater Himalayas

Section A. *Northern Himalayan Section.*—Snow-covered mountains with very high peaks, e.g., Mt. Everest, K2, Kinchinjangha, Nanga Parvat, Nanda Devi. Highly fossiliferous sedimentary rocks from the Paleozoic to the Eocene age. Complex geology. Older rocks are exposed due to action of glaciers etc. The leeward side merges into the Tibetan plateau. Stages of flora and fauna. Sub-Section (a) Tibetan borders.

Section B. *Southern Himalayan Section.*—Wetter parts of the mountains receiving the full force of both the monsoons. Forested areas. Sources of most of the Himalayan rivers. Newer and highly contorted rocks outcrop in some places.

Province III. Middle Himalayas

Section A. *North-West Dry Lands.* Hot and dry region, very cold winters. Marine rocks are exposed.

Section B. *Dun Section.*—Lying between high ranges of mountains, 15,000 to 20,000 feet high. Kashmir a most beautiful Dun or valley, strewn over with lakes and glacial materials. Cut by the Jhelum river. Mountain passes on all sides. Forests on the windward side with rainfall about 25 to 30 inches. Very good mineral resources including coal. Other Duns are Dehra Dun etc. Sub-Sections (a) Indus valley, (b) Jhelum valley.

Section C. *Himalayas Proper.*—Snowline 16,000 feet. Highly folded rocks with thrust faults. Crystalline, metamorphic and Purana rocks with granite intrusions. Unlimited resources.

Province IV. Sub-Himalayan Region.

Section A. *Potwar Section.*—Largely occupied by the Rawalpindi country, cut by the Soan valley. A crumpled geosyncline.

Sub-Section (a) The Salt Range, rich in minerals including rock-salt and oil.

Section B. *Siwalik Section.*—Outer Himalayas, intervening between the Middle Himalayas and the Indo-Gangetic Plains. Low flat hills, 300 to 500 feet high. Tertiary fluviatile deposits. Area

within the Danger Zone. Sub-tropical forests. The foot-hills of the Himalayas formed of sands, gravels, boulders etc. brought down by rivers. Rocks locally folded and overthrust.

Province V. Eastern Highlands.

Section A. *Shillong Plateau.* A detached part of the N. E. Tableland (See below). Heaviest rainfall in India, over 500 inches. Tropical forests grow.

Section B. *The Yomas.*—Related to the Greater Himalayas, consisting of folded Tertiary rocks. Sub-Sections are possible e.g. (a) Assam hills (b) Arakan Yoma etc.

Section C. *Irrawadi Basin.*—A broad valley formed from folded rocks containing oil shales. Over 80 inches of rainfall. Sub-Sections—(a) Upper Irrawadi Valley, (b) Lower Irrawadi Valley, an excellent rice land.

Section D. *Shan Plateau.*—A denuded plateau. Ranges of Archaean rocks separated by plains and dried-up valleys, continued into Tennasarim, Siam and Malaya Peninsula. Rich mineral deposits, such as ruby, silver, tin and lead ores.

Section E. *The Salween Basin*—Heavily forested with evergreen forests.

(2) INDO-GANGETIC PLAIN.

Province I. Lower Indus Valley.

Section A. *Western Valley Section.*—Old alluvium, formed by the detritus from the mountains. Seasonal hill torrents and springs. Rich drift soil consisting of sand belts and clay belts. Floods dreaded, though rainfall scanty. Allied to the Irrawadi valley with chances of mineral oil.

Section B. *Eastern Valley Section.*—New alluvium, crossed and recrossed by Dhoroes (old river channels). Shifting banks of the river. Largely irrigated land. Rainfall insufficient. Kalar soils, salt lakes and salt deposits.

Section C. *Indus Deltaic Area.*—Uncultivated, swampy and sandy in parts. Changing mouths of the river. Many and frequent hydrographical changes. Rice cultivation only higher up. Salt deposits.

Province II. Upper Indus Valley

Section A. *Doab Section.*—Higher ground upto 1,000 feet. Largely cut up by the Punjab rivers as the tributaries of the Indus.

About 25 inches of rainfall including winter showers from Western disturbances.

Section B. *Punjab Proper.*—Lowlands, formed by the detritus from the mountains in the north. Rich drift soil more clayey than the Sind soil. Wheat lands of India. Hydrographical changes in the past. Disappearance of the Sarasvati and the Gaggar. Includes the plains upto the junction of the Indus with the five rivers. Largely irrigated land. Khadar Dried-up area of the Ambala streams.

Province III. Desert Province

Section A. *The Pat Section.*—Covered with clay or silt and with longitudinal Bhits or sandhills. Dhands and salt lakes formed in the valleys. Outcrops of Jurrasic rocks here and there, suitable for Sub-Section (a).

Section B. *The Thar Section.*—Sea of sand-hills with their directions as those of the monsoon winds. Rainfall slightly better and patches of grass are found. Nomadic life.

Province IV. Upper Ganges Valley

Section A. *The Jamna-Ganges Doab.*—Best irrigated and highly cultivated wheat land especially. Contains patches of Reh or Usar (salt) deposits. Force of the monsoon greatly reduced here.

Section B. *Rohilkhand Section.*—Damper and higher, wooded country. Rainfall upto 40 inches. Plain sloping from Delhi (700 feet) to Allahabad (400 feet).

Province V. Middle Ganges Valley

Sections. *(No prominent Sections are possible in this Province)*.—Damper than the Upper Ganges Province. Rice crops more than wheat crops. Thickly populated. Rainfall also more, upto 60 inches. Area within the earthquake zone.

Province VI. Lower Ganges Valley

Section A. *The Brahmaputra Valley.*—On the leeward side of Shillong plateau. Less rain but damp soil, with alluvium overlying ancient plateau rocks. A 'ramp valley.'

Section B. *The Old Ganges Delta.*—Most thickly populated parts of India. Fine, silty and sandy flat. More than 60 inches of rainfall. Includes parts of the old delta with former channels (Bhils) now under good cultivation.

Section C. *The New Ganges Delta.*—Eastern parts of the delta, full of marshes, enclosing swampy islands. Rather unhealthy parts, which are under water during floods. Mangrove swamps, called Sunderbans, holding up silt and sand. Sub-Sections of (a) the Damodar valley and (b) the Meghna valley are possible.

(3) THE PENINSULAR AREA.

Province I. Rajputana Uplands.
(Parts of the oldest but the most highly denuded mountain system).

Section A. *North-western Section.*—Sandy waste. A rolling plateau. Poorly watered. Includes Marwar, harbouring migratory people.

Section B. *Mewar Plain.*—Morphologically varied plain, irregular and gnessic in character. Outcrops of Dharwar rocks with rich mineral deposits, e.g., mica, marble, beryl, steatite. Heart of Rajputana. Relic of the ancient gigantic mountains, down which even glaciers flowed in Permo-Carboniferous times. Now a great synclinorium of tectonic origin. Sub-Section (a) The Aravalli Hills.

Section C. *South-eastern Section.*—Pathar and Uparmal. A triple plateau of concentric scarps of Vindhyan sandstones. Rich diamond deposits.

Province II. Deccan Trap Region.
(Mainly consisting of the Deccan trap rocks, differentially denuded and decomposed in parts)

Section A. *Central India Tableland.*—Basaltic lava rocks, forming part of the Narbada valley in the south and the Vindhya mountain. Flat hill-top topography. Sub-Section (a) the Vindhyas.

Section B. *Western Ghats.*—Highest parts of the denuded tableland. Maximum height 5,000 feet. Full of Deccan lavas and bearing the brunt of the S.W. monsoon. Good rainfall with forests on the windward side. Little disturbed by earthquakes. Flat-topped hills and intervening tableland, cut by river valleys. Sub-Section (a) Forest area. (b) Narbada valley.

Section C. *Bombay Deccan.*—Leeward side of the Ghats mainly. Less rain and thinly populated. Regur or black cotton soil is the lava product. Laterite caps here and there, prominent

in the Tapti valley, through which the monsoon penetrates. Sub-Sections: (a) Laterite caps (b) Tapti valley.

Section D. *Western Peneplains.*—Show surfaces of ancient and recent peneplains with complex structural geology. Rings of Archaean, Deccan Trap, folded Jurassic, Cretaceous and Tertiary rocks, ending in vast shore facies of post-Tertiary age in Cutch and Kathiawar. Effects of marine denudation prominent. Hilly parts yet unstable. Sub-Sections: (a) Cutch—Outcrops of older rocks surrounded by vast alluvial tracts. A shallow swamp in the monsoon season and a sandy desert in the dry season. Has suffered upheaval and subsidence due to seismic movements in the past. Probably formed part of the deltas of the Old Indus and the Hakra of Sind. (b) Kathiawar. A similar block separated from the N.W. plateau by a peneplain of the old Aravallis. Has a coastal plain of Tertiary origin and with some good ports. (c) Gujarat, largely consisting of the shore facies of the Western Ghats. Good cotton soil.

Section E. *Konkan Coast.*—A Pacific type of coast land. Sandy soil suitable for rice cultivation. Nearly 100 inches of rainfall. A plain of marine denudation with rocky spurs here and there with raised beaches or submerged swampy areas.

Province III. North-Eastern Foreland

(Complex groups of denuded rocks ending in a block of old Archaean rocks at the eastern end.)

Section A. *The Mahanadi Basin.*—Archaean gneisses and schists of Bundelkhand, Cuddapah—Vindhya rocks of Bhagelkhand and Gondwana rocks, coal and iron deposits of Bihar. Effects of the double monsoon. Rainfall 40 to 60 inches. Ends in an alluvial fan of the delta and the lake Chilka, the largest in India. Luxuriant vegetation. Sub-Section (a) The delta.

Section B. *The Godavari Basin.*—Gondwana system of rocks with coal and iron deposits. Less rainfall here (30 to 40 inches). A rift valley with sand-banks cultivated. The Nagpur forest plateau with better soil and scattered villages of primitive people, suitable for a sub-section (a).

Section C. *The Eastern Ghats.*—Not worth the name, as the rocks of Archaean origin are highly and unevenly denuded. Rainfall 60 to 80 inches due to the double monsoon. A rolling land of

the Inselberg type with isolated hill ranges, ending in an extensive deltaic plain again.

Sub-Section (a) Forest Belt.

Section D. *Golconda Coast Shore facies of the Eastern Ghats*, including the deltas of the Mohanadi, the Godavari and the Krishna rivers.

Province IV. Southern Plateau.

(Ancient Archaean mass of rocks. A rolling plateau, an Inselberg with reddish soils essentially dusty in the dry season.)

Section A. *Cuddapah Section.*—Rocks of the Cuddapah and Vindhya ages, a crescent of thin rocky soil, forming Sub-Sections. (a) Krishna basin and (b) Penner valley. Horizontal flat hills.

Section B. *Bellary Section.*—Leeward side of the Ghats. A scrubland. Rain shadow area with scanty rain. Good cotton soil. Lower levels of a gently sloping plain.

Section C. *Nilgiri Hills.*—Dharwar rocks with rich mineral deposits Mica, gold, manganese ores. Forested owing to good rains. *Mountain slopes for tea plantations. There are also terraces and* water-falls. The Ghats are cut up by the big Palghat gap, the valley of a lost Gondwana river.

Section D. *Tamil Section.*—Archaean rocks of considerable denudation. Gneisses and schists. Double monsoon and good cultivation in the valleys of the rivers. Sub-Sections: (a) Palghat gap, (b) Tambraparni valley, (c) Palar valley, (d) Cauveri valley.

Section E. *Malabar Coastland.*—Shore facies of the Southern Plateau with belts of sandhills, lake lagoons, foot-hills and hill-slopes. Alluvial plains, cut by short and rapid rivers. Heavy rainfall of the S.W. monsoon. Cocoanut trees grow. Rice land. Few natural harbours.

Section F. *Coromondal Coastaland.*—(Carnatic.) Broad, flat plain rising from 1000 feet and reaching the east coast. Parallel belts from the Ghats to the delta of the Cauvery, and other river deltas. Marine denudation is abundant with resulting platforms.

Summary

Thus the whole of India is first divided into 3 Major Divisions, which are again divided into 15 Provinces, subdivided into 44 Sections and 29 Sub-Sections as under :—

Major Divisions, marked (1), (2), (3)	Provinces, marked I, II, III	Sections, marked A, B, C.	Sub-Sections, marked (a), (b), (c).
(1)	5	14	8
(2)	6	12	4
(3)	4	18	17
Total.. 3	15	44	29

Conclusion

The problem of dividing India suitably and with a view to serve all purposes, economic and others, is getting increasingly urgent. It is the business of Indian geographers to guide the country in this manner. Without their collaboration and co-ordination of researches, there will be a great loss. Various proposals have been made for dividing the country suitably, but the method of physiographic division is the most suitable for all.

For instance, there is the redistribution of the political boundaries of India demanded by the people according to languages. Commenting on certain dynamic problems of India, Dr. A. Geddes said last year. "In view of the burning interest in peninsular India in the question of 'linguistic provinces,' it may be well to mention certain *related* problems. The relation of language, of religion, and of other criteria of culture, not only to each other but to economic distribution can undoubtedly be clarified by conscientious use of *geographic method*. In Southern India at this time when few regard the internal political boundaries as either economic, just or final, I was struck by the rarity of any discussion of possible economic provinces. The concept of the region and even the word is rarely met with. I have little doubt that, as the mapping of important distributions proceeds without slavish adhesion to existing *political boundaries*, geography can do much to guide the reformation of her internal political frontiers." No doubt the Madras Geographical Association has made a good beginning with local and regional problems. Had we but succeeded in making a satisfactory division of India to serve such purposes, we, Indian geographers, would have got greater credit than what foreigners have been able to give us. In our efforts to do so, we are really helped by nature. When we know, for instance, how well the Province of Western Peneplains, proposed by me, includes all Gujarati-speaking people and the Deccan Trap Province all the Marathi-speaking

people, the hope of making a division of our country physiographically to meet all our requirements could be fulfilled at last.

Even for the purposes of a Federated India, the scheme proposed by Sir Sikander Hyat Khan, of dividing India into certain zones, can be helped and improved upon by us geographers, and the difficulty of bringing, into the Federation, all the British India provinces and the Native States, not as two distinct components but as integrated parts of a completed whole, can be solved on the regional basis. "It will encourage collaboration between contiguous units, i.e., both British Indian provinces and Indian States whose geographical proximity, common language and affinity of economic and other interests form natural ties to bind them together." So also in the matter of communications, sharing of economic resources, racial and cultural relationships, etc. such physiographic divisions would be ideal and the services, rendered by Indian geographers to India in this connection, will be valuable. If Sir Sikander Hyat Khan's scheme of the seven zones is substituted by that of the 15 physiographic provinces proposed by me, it would serve the purpose well and an excellent *uniformity* could be attained from the points of view of representation and administration. It would, indeed, conduce to the solidarity of the whole country and the stability of the Central Government for all times. Let me hope that this dynamic problem will receive a satisfactory solution during the year 1940.

The Direct Study of Geography

Hints and Suggestions with special reference to Saidapet.

BY

N. SUBRAHMANYAM

Under the above caption goes an important section of the new L.T. Syllabus in Geography, which reads as follows:—"The observation and expression of the facts of Local Geography: the possibilities and uses of different environments. (This should be done through a practical study either of the student's home region or of the home region of the Training College)."

As the home regions of the students under training will necessarily be different, it is proposed to offer some hints and comments regarding some of the main topics relating to Saidapet in a suggestive rather than a comprehensive way. It is expected that the students will be able to apply and follow them up for their own respective places also, when they return to them. Probably it is unnecessary to state that it is not a full regional survey that is intended, as that term is applied for what is a good deal more than Geography. But in so far as the geographical part of it (which is its core) is concerned, its aims and methods may be adopted especially by way of personal investigation, recording the data, mapping the distributions and expressing the data diagrammatically.

The start may be made by getting a *bird's-eye view of the whole locality* from what may be called, an "outlook tower"—an eminence in the neighbourhood such as the top of St. Thomas Mount, and fixing the features and landmarks with the help of *the one-inch topographical map* of the Survey of India. With the same map or better still with one on a bigger scale, preliminary rambles may be made to different parts of the town, noting facts and features not to be found in the map owing to changes having taken place since the map was prepared at first, either by removal or by addition and growth. For example, on the latest one-inch map the present Teachers' College is still shown as Agricultural College, in spite of the fact that it is over 30 years since the latter was removed to Coimbatore. Conversely, Todhunternagar, Y. M. C. A. College of Physical Education, the Golf Links, the Richards Park, Panagal Buildings, Water storage tank, etc., do not

find a place in it. It is a good exercise for groups of students to go round the different parts of the locality and note such changes in an outline map.

Surveying the college compound, contouring levels near the Adyar bank or Little Mount, and sketching the different areas visited and noting the features observed and the routes are other important items of practical work, connected with map-making.

The times and exact directions of *sunrise and sunset* and *midday altitudes* of the sun should be noted periodically in the course of the year, expressed diagrammatically and correlated with the seasons. The method of finding and drawing the meridian line should be learnt and applied. Simple methods of finding the midday altitude of the sun will be learnt incidentally.

The surface levels and features and the courses of the Adyar and the Cooum, especially the curves and the bed of the latter, should be observed and noted in rambles and visits, gathering evidences of erosion and deposition. Specimens of rocks and soils in the neighbourhood should be collected, examined and classified. Peeps at bed-rock may be obtained in railway cuttings and in diggings made for underground drainage, wells or foundations for buildings. The changing water-table in the wells of the different parts of the locality should be noted in the different seasons. Visits to the countryside and to the rivers in flood are particularly useful in illuminating much that is otherwise purely theoretical in the study of physical geography.

Weather recording offers a specially rich field for observational work. Wind direction, maximum and minimum temperature and rainfall are some of the chief items to be observed, recorded and expressed in appropriate diagrams such as the wind-rose and the climograph. The results of observational work may be compared with published normals and actual figures available in the meteorological reports.

Preparation of *land utilisation maps* affords scope for another valuable kind of direct study of environment. Important public buildings, groups of residential areas, cultivable lands, open spaces, parks, etc., may be noted in special outline maps and studied side by side with the topographical map as already suggested. The straggling nature of the municipality of Saidapet, extending from Chengamedu on the right bank of the Cooum through Puliyur, Kodambakkam, Saligramam, West Mambalam, Mettupalaiyam, and Saidapet proper to Guindy and Little Mount beyond the Adyar river, with large stretches of cultivated and barren land and brick pits intervening, the water-works, the bazaar, the temples, mosques

and churches, and the groupings of the people in communitie occupational or otherwise should all find their places in the ma The difficulties of natural drainage (said to be due to the bundin up of the Adyar bank for the construction of the Marmalon bridge), the methods of disposal of sullage water and their relatio to public health are worthy of note.

On the economic side, there are important items to observ and collect data about. In the adjoining cultivable lands, agricu ture is precarious owing to poor fertility of the soil and want c irrigation facilities; but, market gardening, especially of vegetable and flowers, is more important, owing to the proximity of the towr The brick industry is a flourishing one; the location of the kiln the soil and other conditions, transport and market are to be studied The weaving industry of Thopet is another local industry to b investigated. The locality, the community engaged in it, the kind of stuff woven, the market and the present condition of the indus try should be inquired into. Dhobying is another well-know occupation in Saidapet, the bed of the Adyar being a dhobykhan of Madras. The easy transport and the fresh water in the rive above the tidal limit as well as the presence of the washer class i connection with the bleaching work of the weaving industry shoul be noted as favouring causes. Jutka-making and jutka-repairin were well-known in Saidapet; but this industry seems to hav fallen on evil days with the growth of the motor transport and th running of the electric train.

Regarding *the population*: besides noting its distribution in th several wards, it will be interesting to find out the extent to whic Saidapet is suburban in character, that is, what proportion of it inhabitants are working for their livelihood in Madras and not a Saidapet. The relative popularity of the train and the bus is a interesting piece of investigation to make.

Taking *the road transport*: the southern trunk road—or th Mount Road as it is called here, as leading to St. Thomas Mount—with its width, tarring, etc., and the colleges, and open spaces o either side of it—is what gives the best impression of Saidapet t the casual passer-by. But the other roads, especially those linkin Saidapet with West Mambalam, Saligramam and Chengamed should be visited, and the causes for their bad condition should b investigated: e.g., the effect of brick carts, bad finances of th municipality or the unremunerative nature of some of these road having to link up distant residential areas. The traffic in the trun road should be observed and noted at different times in the da

and in the different seasons, as to the kinds of goods taken and as to how far it is local and how far 'through'. Some of the commonest in evidence are brick, straw, hay, grain, curds and vegetables in head loads, fish in Ford cars from Sadras, hides and skins, tanning materials. Note the extra hard cementing of the sides of the road for heavy laden carts to pass. Note also the diversion of the slow traffic on race days through Alandur road, when the congested motor traffic has to pass through the bottle-neck of the Marmalong bridge. The seasonal fruits, flowers and vegetables in the market and in the field should also receive attention.

One of the most interesting topics is the study of the formation and growth of the different *types of settlements* in the locality itself: for example, Guindy and Fanepet as roadside settlements; Little Mount as a Christian settlement round the place of martyrdom of a Saint; the weaving ward of Thopet with its broad open streets for pitching the looms; the old type of settlement round a temple as in Perumal Koil St., Karaneeswarar Koil St., and southern part of West Mambalam; the bungalow type near the Guindy Railway Overbridge. The location of particular trades and occupations in particular places is to be noted; as the dhoby near the river, the potter just on the outskirts, the jutka-repairer near the main road and the binder near the college.

Further, as Saidapet is a suburb of Madras, lying on the trunk road and the electric railway (four stations on which serve the municipality) possibilities of planning new extensions on the lines of Theagarayanagar may be examined and explored, taking into account the lie and structure of the land and facilities of water-supply, drainage, open space, etc.

Geography has as much to do with man's play and leisure as with his work: and sports competitions and physical demonstrations in the colleges, the races at Guindy, the festivities in the Little Mount and of the Karaneeswara temple that draw large crowds from the city and its environs are noteworthy—the times and seasons when they take place, the incidental increase of trade and transport in particular directions at the time of the festivities, and how far they disturb the normal even life of the residents and their other reactions.

Possibilities of improvement are not outside the scope of local study. It is unnecessary to repeat that personal observation, collection of data, mapping and diagrammatic expression, and interpretation should all go hand in hand in such a study. Most of this can be co-operative work.

Select Contents

The Geographical Journal: October 1939.
The Irrawaddy Plateau—By F. Kingdon Ward.

The Geographical Journal: November 1939.
Peaks of the Assam Himalaya—By H. W. Tilman.

The Geographical Magazine: October 1939.
Poland in Danzig—By Prof. Bernard Massey.
Art and Life in Bali—By Dr. F. C. E. Knight.

The Scottish Geographical Magazine: September 1939.
Some Aspects of Conservation in the United States—By Gordon Bowen.
Diffused Light and Sunlight in relation to Relief and Settlement in High Latitudes—By Alice Garnett.

Geography: September 1939.
Recent Economic and Social Developments in Sa'udi Arabia—By A. McKie Frood.
Notes on the Construction of Simple Meteorological Instruments—By J. H. G. Lebon.
The Cinema and Geography in Senior Schools—By J. W. L. Symes.

The Journal of the Manchester Geographical Society: Vol. XLIX, 1938-39.
Through India, Iraq and Sudan—By Sir William Himbury.
Forbidden Bhutan—By John Davie.
Kenya Colony—By W. F. Machin.

Geographical Review: October 1939.
A New Coefficient of Humidity and Its Application to the United States—By Phil. E. Church and Edna M. Gueffroy.

Journal of the Andhra Historical Society: Vol. XII, Part II.
The Soras and Their Country—By G. V. Sitapati.

Indian Information: October 1, 1939.
Facts and Figures re: Irrigation and Power Development from Water in India.

Indian Information: December 1, 1939.
India's River Problems: What Research can do.

News and Notes

Three meetings of the Association were held in the last quarter of the year (October-December) ; and in these the series of talks to teachers of geography, carried on in the previous quarter, were continued and completed. On 14-10-'39 *Mr. B. Clutterbuck* spoke on '*the Use of Diagrams in Teaching Geography*'. On 28-10-39 *Mr. George Kuriyan* delivered a lecture, illustrated with slides, on '*the Far Eastern Problem.*' On 25-11-39 Miss J. M. Gerrard completed the series with a talk to teachers on '*the Lesson Plan.*'

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An excursion by bus was organised to Vellore on 16th and 17th December 1939 and conducted by the Secretary, visiting *en route* the Victory Memorial Blind School at Poonamallee, the shale-beds at Sriperumbudur and Conjeeveram. On the afternoon of the first day the historic fort at Vellore was visited and the Vellore hill (1,670 feet) climbed. The following day the party climbed Kailasgarh (2,741 feet), 5 miles from Vellore, and returned to Madras the same night.

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The Tenth Geographical Conference of the Association will be held at Ambasamudram in the Tinnevelly District in May 1940, when papers on various aspects of the Geography of the District will be read and discussed. Further details regarding the Conference will be announced in due course.

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Mr. P. G. Dowie of the Geological Department, Presidency College had contributed a paper to the Ninth Geographical Conference at Madras on '*The Physical Aspects and Geology of the Neighbourhood of Madras,*' which has been included in this issue. In this paper he has brought together a good deal of material found scattered in the Memoirs of the Geological Survey of India and presented them in an interesting and exhaustive manner from his intimate personal knowledge of the region.

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Prof. M. B. Pithawalla of Karachi has revised in this issue in some details his plan for a division of India into Physiographic Re-

gions presented to the Lahore session of the Indian Science Congress and published in the previous issue of the journal.

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We welcome with pleasure *Mr. Nafis Ahmed*, M.Sc., Lecturer in Geography, Muslim University, Aligarh, as a contributor to our journal. His paper on '*Muslim Contributions to Geography*' published in this issue, will be found interesting. It is understood that Mr. Ahmed has been appointed Profesor of Geography in the Islamiah College, Calcutta, and that he will be leaving Aligarh shortly.

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The 27th Session of the Indian Science Congress will be held in the Medical College, Madras from the 2nd to 8th January 1940 under the presidency of Prof. B. Sahni, F.R.S. The Geography and Geodesy Section of the Congress will be presided over by *Dr. Shibaprasad Chatterjee* of Calcutta University, whose address will deal with '*the Place of Geography in National Planning.*'

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The main item of business in the special meeting of the General Committee of the Congress is the re-grouping of the Sections; and among the proposals is one to transfer Geodesy to Mathematics section, to be called the section of Mathematics, Astronomy, Statisics and Geodesy, and another to amalgamate Geography and Geology sections into one as it was before the Jubilee Session at Calcutta in 1938.

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The British Association met in Dundee on August 30, 1939; and in section E (Geography) about one third of the papers had been read when on September 1st the Session was interrupted upon receipt of the news of the German invasion of Poland.

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"The Presidential Address to Section E, delivered on September 1, by Mr. A. Steevens, contained a lucid examination of the most conspicuous geographical concept whose ennunciation is associated with British Geographical thought, the concept connected with the phrase *Natural Geographical Region*, especially in so far as it is exemplified in North America, Russia and Europe. It appears to Mr. Steevens that the unity of the natural geographical region is dependent in large measure upon organisation, in the shape particularly of communications,.......... In Western Europe

the increased efficiency of communication and recently the peculiarly intimate cohesion organised by the radio, have so far expanded the area throughout which a perfect neighbourliness may be found that it is possible nowadays to define the European nation-state as 'a community occupying a natural geographical region as its immediate environment, because it is a natural growth limited by its Geographical circumstances.'

With the break-up of the session, progress with plans for a British National Atlas proposed by Prof. E. G. R. Taylor at the Cambridge Session last year, had now to be delayed indefinitely.

Few of the social functions and none of the longer excursions had taken place when the session abruptly closed."

—*Scottish Geographical Magazine,* Sept. 1939.

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The invasion of Finland, the latest instance of unprovoked aggression by a mighty power on a small state and the heroic resistance of the latter against odds should ultimately lead through untold suffering to a new world order in which freedom and safety can be vouchsafed for all peoples of the world, big or small, in Europe or elsewhere, whether through the League or through a new federal union.

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Reviews

Geology and Allied Sciences: Part one—German and English. By Walther Huebner. (Veritas Press, New York). 1939. Price $7.50.

This volume is a thesaurus and a co-ordination of English and German terms in Geology and allied sciences. Owing to the lack of a comprehensive and up-to-date thesaurus of geological terms in any modern language there has been a great gap in international geological literature which has been filled in a large measure by this monumental volume, the fruit of 15 years of research work. This thesaurus, with its more than 25,000 entries in each language presents a practically complete collection and co-ordination of German and English specific and general terms. While adhering strictly to the terms in actual use, the author has taken care to point out where terms have been incorrectly or wrongly used; and in some cases obvious mistakes have been corrected.

Regarding the wide-spread confusion about the meaning and position of the stratigraphical levels from the *Cambrian* to the *Silurian*, century-old discrepancies have been attempted to be eliminated by giving at the end of the book (p. 404) a table showing the various levels in their historical development and their proper co-ordination as indicated in the last column of this table.

The volume is complete not only by reason of the number of terms, but also by its comprehensiveness, including terms not only of Geology proper, but also of a number of allied sciences such as biology, geography, meteorology, physics etc., in proportion to their relationship to Geology.

A very useful feature of this book is the grouping of related terms under one key word, thereby facilitating a general survey of related geological terms. We have no doubt that this comprehensive volume will be welcomed as much by the geographer as by the geolcgist.

Poland and its Frontier. By S. P. Chatterjee. 1939. (Bulletin No. 1 of the Calcutta Geographical Society).

This is a monograph based on 'Europe Centrale' by E. de Martonne and 'Poland' by R. H. Kinvig—presenting briefly the funda-

mentals of the geography of Poland. The correlation of the regional background and the human activities of the country have been well brought out in a general way and illustrated by fine sketch-maps and a full-size map of Poland.

Our Presidency and Country (Tamil). By A. N. Schwartz. (Christian Literature Society for India: Madras). 1939. Price As. 8.

This class-book of Geography for standard 5 of elementary schools is written by an experienced teacher of Geography in strict accordance with the recent syllabus for elementary schools issued by the Madras Educational Department. It, therefore, suffers from the inherent defects of that syllabus in being ambitious, exhaustive and too logical; but the author has succeeded in making the treatment interesting and inspiring. The suggestive and stimulating questions and exercises at the end of each chapter and the numerous sketch-maps, pictures and diagrams enhance the value of the book, whose big bold type and neat get-up render it particularly attractive to children.

The Atlas Geography of South Arcot District. (Tamil). By K. Narayanaswami Ayyar. (K. N. Publishing House: Villupuram). 1939. Price annas 5.

This text-book of Geography for pupils in standard 4 of elementary schools in the South Arcot District has also been prepared in accordance with the latest syllabus of the Madras Educational Department; and so suffers from the defects of that syllabus in being logical, analytical and too factual in treatment. But big bold type, diagrams, sketch-maps and illustrations and simple language are some of its merits.

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